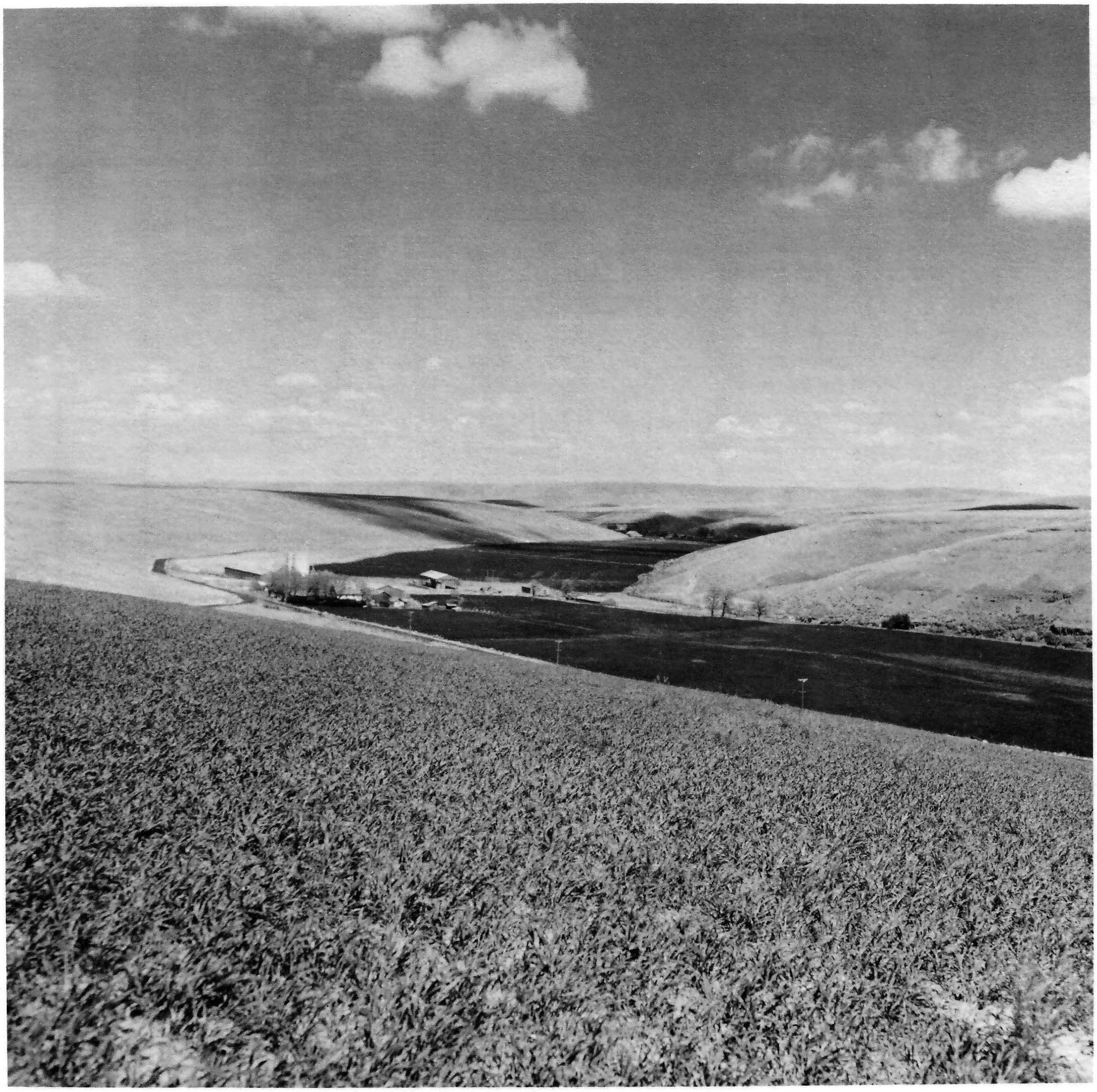
United States
Department of
Agriculture

Soil
Conservation
Service

In Cooperation with
Oregon Agricultural
Experiment Station

Soil Survey of Morrow County Area, Oregon



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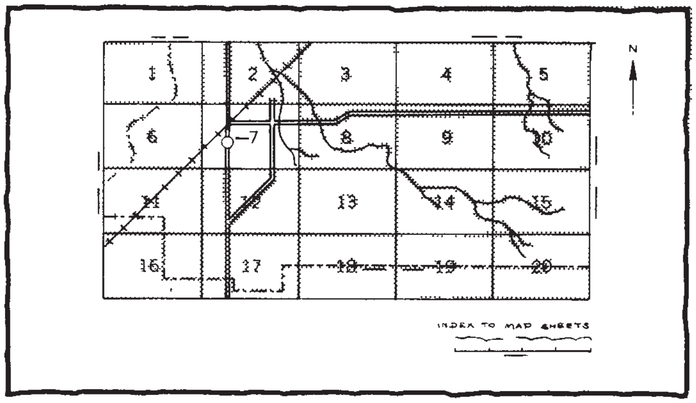
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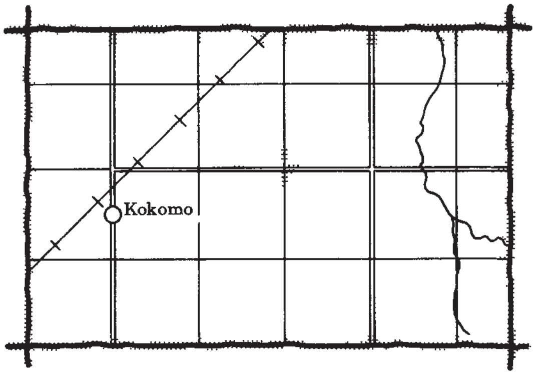

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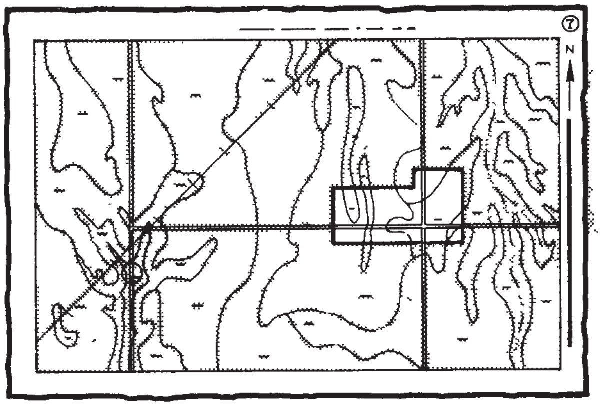

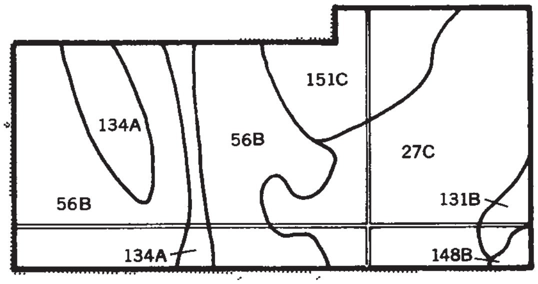
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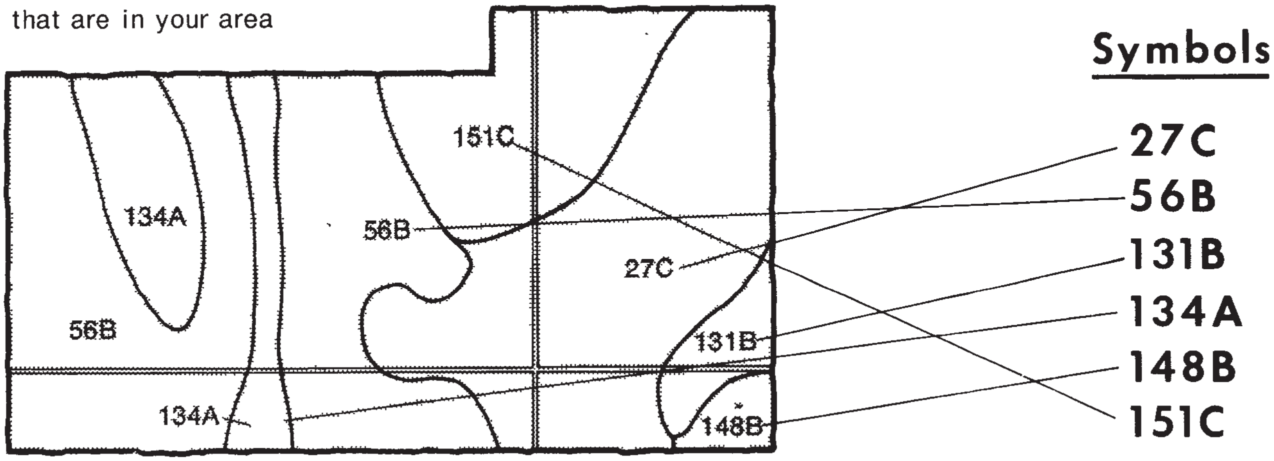
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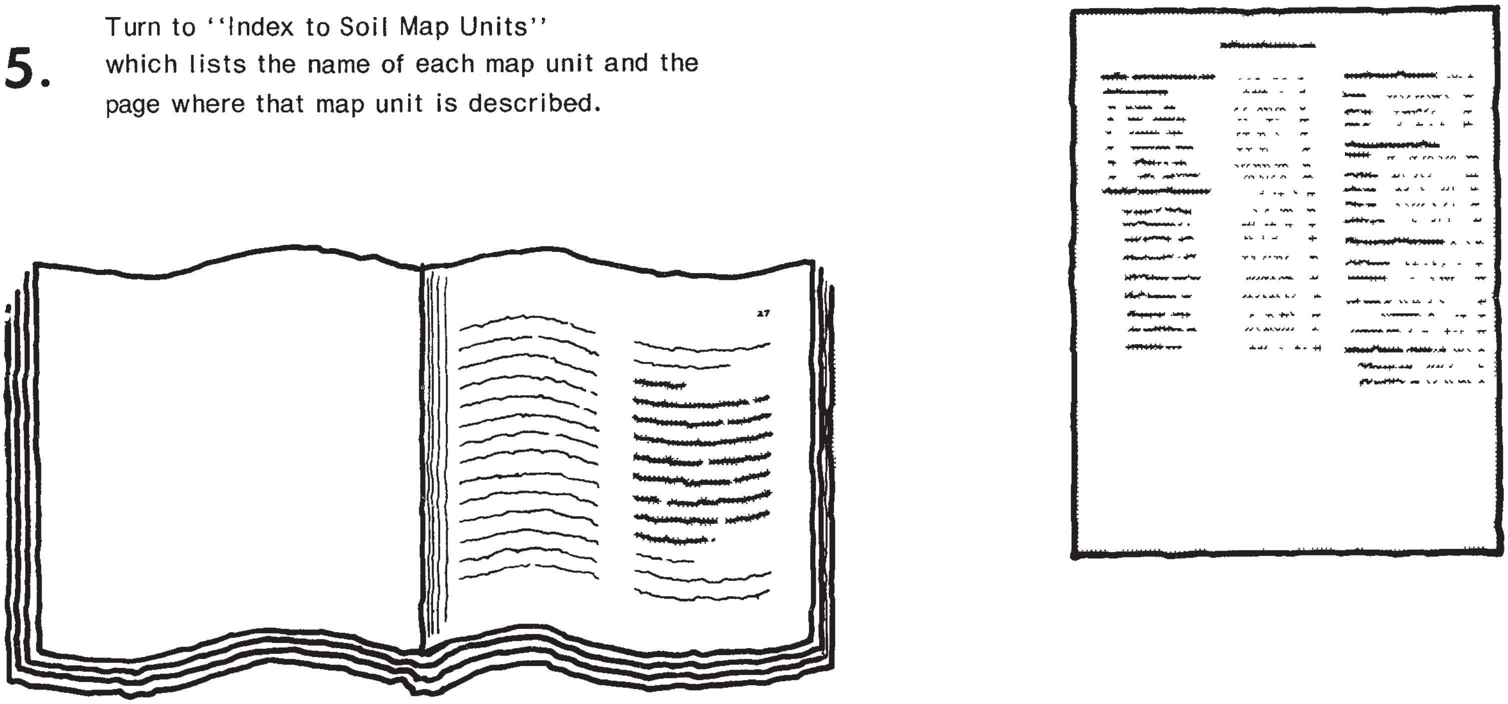
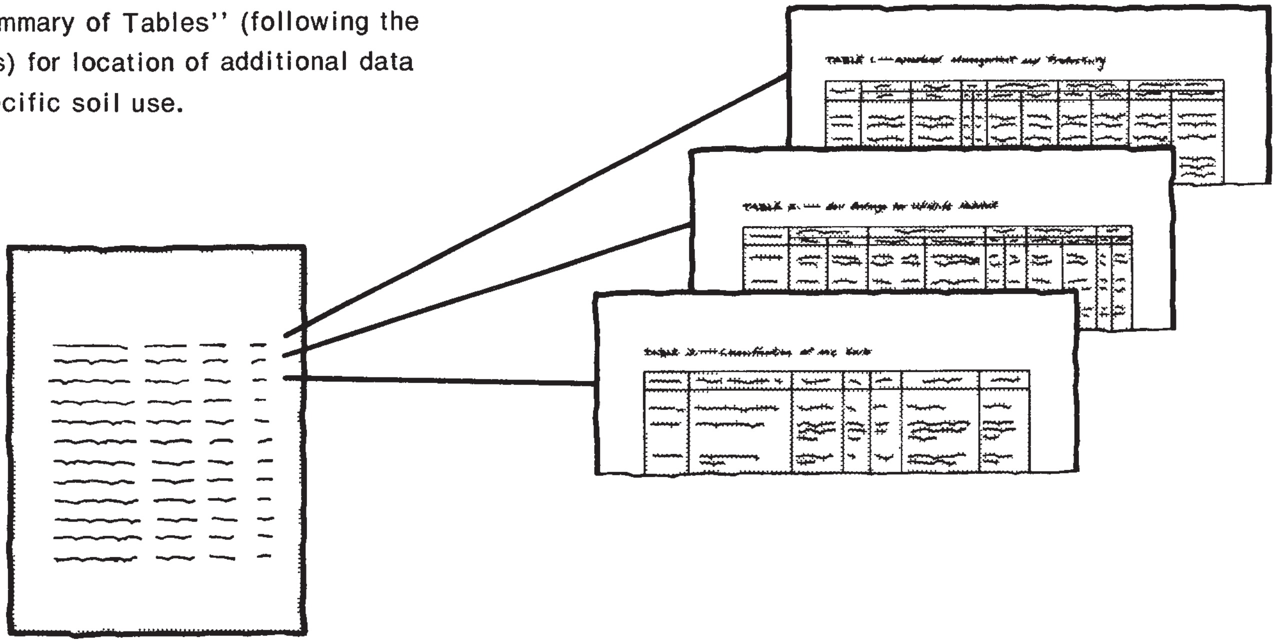
THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1969-76. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1976. This survey was made cooperatively by the Soil Conservation Service and the Oregon Agricultural Experiment Station. Morrow County provided funds during the course of the survey to accelerate the soil survey fieldwork. This survey is part of the technical assistance furnished to the Morrow County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Dark strip on bottom land along Little Butter Creek is Onyx silt loam. The crop is irrigated alfalfa. In the foreground is wheat on Ritzville silt loam, 12 to 20 percent slopes.

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Foreword

This soil survey contains information that can be used in land-planning programs in Morrow County Area, Oregon. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

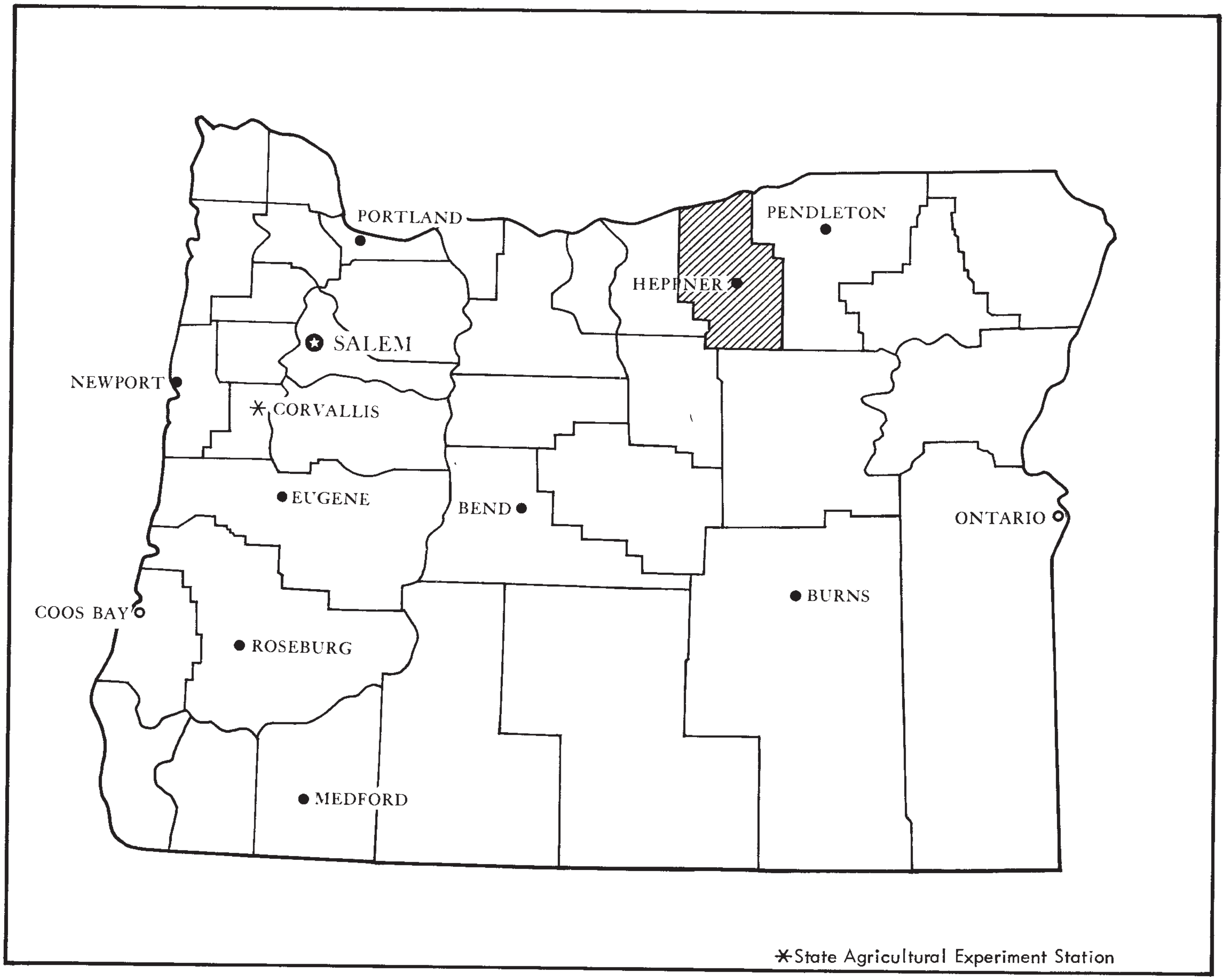
This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Guy W Nutt

Guy W. Nutt
State Conservationist
Soil Conservation Service


PORTLAND
PENDLETON
HEPPNER
SALEM
NEWPORT
CORVALLIS
EUGENE
BEND
ONTARIO
BURNS
COOS BAY
ROSEBURG
MEDFORD
✳State Agricultural Experiment Station

Location of Morrow County Area in Oregon.

Soil survey of
Morrow County Area, Oregon

By Richard E. Hosler, Soil Conservation Service

Fieldwork by Richard E. Hosler, David R. Johnson, Duane K. Monte,
George L. Green, Terry A. Dallin, and Dal F. Ames, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with the Oregon Agricultural Experiment Station

The MORROW COUNTY AREA is in the north-central part of Oregon. Heppner, the county seat, has a population of 1,500. The county has a total land area of 1,317,700 acres. The area surveyed is 1,311,143.

General nature of the survey area

On the pages that follow is general information on the climate of the Morrow County Area, the physiography, relief, and drainage, the history and development, the natural resources, and the farming and ranching.

Climate

By Ben Davis, meteorologist, Statistical Climatology Branch, Environmental Data Service, National Oceanic and Atmospheric Administration, Asheville, N.C

The Rocky Mountains partly shield Morrow County from strong arctic winds. Winters are cold but are generally not too severe. In summer Pacific Ocean winds are partly blocked by the Coast and Cascade Mountain Ranges. Days are hot, but nights are fairly cool. Except in mountainous areas, precipitation is scant in summer. In many places, however, it is adequate during the cooler parts of the year for unirrigated small grain or rangeland. The snowpack accumulation at high elevations supplies irrigation water for intensive farming in parts of the lowland.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Arlington and Heppner, Oregon, in the period 1931 to 1973. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

Along the Columbia River in winter the average temperature is 37 degrees F, and the average daily minimum temperature is 30 degrees. The lowest temperature on record, which occurred at Arlington, Oregon, on January 27, 1957, is -22 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 89 degrees. The highest recorded temperature, which occurred at Arlington, Oregon, a few miles west of Morrow County, on August 4, 1961, is 115 degrees. In winter farther south in the county where the elevation is about 2,000 feet, the average temperature is 36 degrees F, and the average daily minimum temperature is 28 degrees. The lowest temperature on record, which occurred at Heppner on January 26, 1957, is -15 degrees. In summer the average temperature is 66 degrees, and the average daily maximum temperature is 82 degrees. The highest recorded temperature, which occurred on August 5, 1961, is 107 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Frost kills many crops at 32 degrees F. It kills some crops only if the temperature is 28 degrees or lower. The length of the period between the last killing frost in spring and the first killing frost in fall, at 32 degrees and at 28 degrees, is given in the descriptions of the soil map units in this report.

Of the total annual precipitation, 2 inches, or 25 percent, falls along the Columbia River in April through September, which includes the growing season for most crops. During this same period, 5 inches, or 40 percent, falls at elevations that are higher but are below the forest. In 2 years out of 10, the rainfall in April through September is less than 2 inches along the river and is less than 5 inches farther south. Thunderstorms occur on about 10 days each year. Most occur in summer.

Average seasonal snowfall ranges from 9 inches along the Columbia River to 17 inches at the higher elevations, but below the forest. The greatest snow depth at any one time during the period of record was 12 inches. On the average, 8 days have at least 1 inch of snow, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 60 percent. The sun shines 80 percent of the time possible in summer and 30 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 11 miles per hour, in April.

Physiography, relief, and drainage

The survey area is within the Columbia Basin, the Columbia Plateau, and the Blue Mountain physiographic provinces. The area within the Columbia Basin Province is a lava-floored plain overlain by sand, gravel, and silt. This material, deposited during past flooding and damming of the Columbia River, was further reworked by wind. The Columbia River, which marks the northern survey boundary, has an average elevation of about 250 feet. Elevations in this region range from about 250 feet along the Columbia River to about 1,000 feet at the southern boundary. The terrain is dominated by a mixed rolling and nearly level relief.

The Columbia Plateau is a lava-floored plain that has been uplifted since molten basalt flooded the area. In Morrow County the basalt is overlain by wind deposited silt or loess. Elevations in this region range from about 500 feet on some bottom lands to about 4,300 feet where the plateau borders the Blue Mountains. This region is dominated by nearly level to rolling, stream-dissected terrain.

The Blue Mountain region is a tilted, folded, and faulted uplift of the Columbia River basalt and older underlying rocks. Topography is largely the result of erosion and stream cutting in the basalt. Flattopped ridges, broad flats, steep-walled canyons, and mountain slopes characterize this section of the county. Ash deposited during the past volcanic activity in the Cascades influences the soils in this region, especially the north-facing slopes. Elevations range from about 2,600 feet along some canyon bottoms to about 5,900 feet at the summit of Black Mountain.

The Blue Mountains, in the southeastern part of the county, divide the two main watersheds in Morrow County. North and west of the mountain summits, drainage is to the Columbia River, except for Rock Creek, which flows to the west into the main fork of the John Day River. South and east of the summits, drainage is to the north fork of the John Day.

The drainage pattern is controlled mainly by the underlying basalt. Channels have been modified but little by the mantle of loess. Stream gradients are determined by the tilt of the basalt.

Most of the area, about 1,072,000 acres, drains to the north into the Columbia River. The major waterways in this watershed are Butter Creek, Rhea Creek, Willow Creek, Eight Mile Canyon, and Sand Hollow. The Rock Creek Watershed, about 101,000 acres, drains to the west into the main fork of the John Day River. The rest, about 145,000 acres, drains to the south into the north fork of the John Day River. The major waterways in this watershed are Ditch Creek, Potamus Creek, Alder Creek, Wall Creek, and Johnson Creek.

Elevations of some of the towns are Irrigon, 300 feet; Boardman, 300 feet; Butter Creek Junction, 1,000 feet; Ione, 1,000 feet; Lexington, 1,440 feet; Heppner, 1,950 feet; and Hardman, 3,560 feet.

History and development

The Lewis and Clark expedition of 1805-06 on the Columbia River passed north of what is now Morrow County (*6*). The Oregon Trail, in the early 1840's, crossed the county about 15 miles south of the Columbia River.

The first permanent residents of the area arrived in the 1850's. They were mostly stockmen who grazed their cattle and sheep on the fine bunchgrass rangeland of the county.

In the 1870's and 1880's more settlers came. Most came as homesteaders. They planted and harvested wheat on the rolling hills from Ella in the north to Rawdog, now Hardman, in the south.

Morrow County was organized in 1885 from the western part of Umatilla County. In 1890, the population was 4,215. It increased to a high of 5,617 in 1920. In 1974, the population was 4,750.

Heppner, the county seat, has a population of 1,500. Boardman, the fastest growing town, has a population of 525. Ione has 435 people, Irrigon 335, and Lexington 245. Hardman still has a few inhabitants as does Cecil, the first settlement.

Natural resources

The major natural resources important to Morrow County are the soil, the waters of the Columbia River and other perennial streams, the underground water, the timber produced in the southern part of the county, the wildlife, and the recreation facilities. Mineral resources of value are scarce in Morrow County.

The Columbia River provides valuable irrigation water to northern Morrow County. As a result of irrigation, farming is more intensive, yields are higher, and droughty, formerly unproductive soils are now productive cropland. In addition, the Columbia River provides barge transportation of crops to larger ports and also provides hydroelectric power.

In the north-central part of the county, underground water supplies tapped by deep wells provide valuable irrigation water. Water in the few perennial streams in the central part of the county also provides irrigation water along their channels, increasing alfalfa and wheat yields. Rock Creek, Rhea Creek, Willow Creek, and Butter Creek are the major perennial streams in the central part of the county.

The southern part of Morrow County, an extension of the Blue Mountains, receives sufficient precipitation to support trees. Douglas-fir and ponderosa pine are the two dominant species. Conditions are favorable for good stands of marketable timber. The harvested logs are trucked to a mill at Heppner, as well as to mills in other areas. Also of value in this forested area are potential for recreation and wildlife habitat.

Morrow County has a wide variety of wildlife—another important natural resource. In the forested regions are Rocky Mountain elk, mule deer, black bear, blue and ruffed grouse along with a variety of other birds and mammals. Abundant throughout the rest of the county are mule deer, cottontail, coyote, badger, ring-necked pheasant, chukar, Hungarian partridge, hawk, owl, and golden eagle. Along the Columbia River and inland lakes in the northern part of the county, are large flocks of geese and ducks. The Columbia River and some of the main rivers in the forested region also provide habitat for a variety of fish, such as trout, salmon, and steelhead. Some of the lakes in northern Morrow County also support populations of panfish and bass.

The forests offer hunting, fishing, camping, hiking, horseback riding, swimming, and skiing. The rest of the county offers hunting, fishing, and boating.

Farming and ranching

The first settlers in Morrow County were mainly sheep and cattle ranchers. Homesteaders arrived in the 1870's. They settled on land extending from Ella in the north to the present community of Hardman in the south, breaking out the native bunchgrasses and growing mainly wheat in a crop-fallow rotation. Because of poor transportation and distances to market, most of the crop was consumed locally. In 1889, however, the railroad line along Willow Creek from the main line on the Columbia River was completed to Heppner (*6*).

Gasoline- and diesel-powered tillage and harvesting machinery has increased the size of operating units. Winter wheat and spring barley are grown almost exclusively in the dryland area.

A combination of the "black fallow," low crop-residue tillage, and the dry winds of the 1930's resulted in severe wind erosion, poor crops, and dust bowl conditions. In 1937 the Lexington Blow District, the first conservation district in the United States, was formed. On October 4, 1941, the Heppner Soil Conservation District was founded. It was bounded on the north by the Willamette baseline. It incorporated the Lexington Blow District. In the north, the Boardman Soil Conservation District was organized on May 5, 1947. On September 20, 1972, the two districts were combined forming the Morrow County Soil and Water Conservation District.

The dry northern part of Morrow County is not arable without irrigation. The mean annual precipitation is only 7 to 9 inches. In 1975, about 60,000 acres was irrigated, mainly by center pivot irrigation systems supplied by deep wells. The main crop is potatoes. Wheat, beans, corn, and hay are also grown. The irrigated acreage in this part of the county has increased rapidly in recent years. A wide range of crops can be grown under irrigation.

About 433,000 acres, or 33 percent, of the survey area is cropland. About 175,000 acres of this land is fallowed each year. About 45 percent of the survey area is pasture and rangeland. About 19 percent is forest and woodland of which 58 percent, or 136,000 acres, is national forest.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures (*12*). They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

General soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Descriptions of map units

Areas dominated by moderately deep to very deep, well drained to excessively drained soils

These soils are on terraces near the Columbia River. The slope is mainly 0 to 20 percent. About three-fourths of the acreage is excessively drained and somewhat excessively drained. The rest is well drained. Soil blowing is a severe hazard.

Irrigation is commonly needed because precipitation is low. If irrigated, these soils produce a wide variety of crops.

Six map units are in this group.

1. Winchester

Very deep, excessively drained sands

This map unit consists of nearly level to hilly, hummocky, and dunelike soils on terraces. The soils formed in alluvial sand over alluvial deposits of gravel or material weathered from basalt bedrock. The vegetation is Indian ricegrass, bitterbrush, shrubs, grasses, and forbs. The elevation ranges from 300 to 700 feet. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 150 to 200 days at 32 degrees F. and 180 to 215 days at 28 degrees.

This unit makes up about 1 percent of the survey area. It is about 85 percent Winchester soils and 15 percent Burbank soils, Quincy soils, and Dune land.

Winchester soils, on hummocky terraces, are excessively drained. They have a surface layer of very dark grayish brown sand and a subsoil and substratum of very dark gray coarse sand. Depth to bedrock is more than 60 inches.

This unit is used for range and wildlife habitat and, where irrigated, for pasture, small grain, corn, and potatoes. The sparse vegetation is a limitation for wildlife. Birds and small mammals are common. The unit supports small populations of mule deer. In areas of irrigated crops, it provides habitat for upland game birds, such as ring-necked pheasant. Because it is near the Columbia River, it also provides habitat for waterfowl.

Runoff is medium on the steeper slopes and slight in the more level areas because of the coarse texture. It is not a serious limitation. Sediment from runoff is low. The hazard of soil blowing is high. A maximum plant cover on rangeland and timely seeding, cultivation, and irrigation minimize the hazard of erosion.

2. Quincy-Koehler

Moderately deep and very deep, somewhat excessively drained loamy fine sands

This map unit consists of gently sloping to hilly soils on terraces. The soils formed in alluvial sand over alluvial gravel deposits, a hardpan, or basalt. The vegetation is needleandthread, Indian ricegrass, shrubs, grasses, and forbs. The elevation ranges from 250 to 800 feet. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 140 to 200 days at 32 degrees F. and 180 to 230 days at 28 degrees.

This unit makes up about 8 percent of the survey area. It is about 70 percent Quincy soils, 25 percent Koehler soils, and 5 percent Burbank, Hezel, and Royal soils and Dune land.

Quincy soils, on terraces, are somewhat excessively drained. They are dark brown loamy fine sand throughout. Depth to bedrock is more than 60 inches.

Koehler soils, also on terraces, are somewhat excessively drained. They have a surface layer of very dark grayish brown loamy fine sand and underlying material of dark brown and brown loamy fine sand. A hardpan is at a depth of 20 to 40 inches.

This unit is used for range and, where irrigated, for pasture, small grain, corn, and potatoes. It also provides wildlife habitat. It supports small populations of mule deer. Birds and small mammals are common. In areas of irrigated crops, the unit provides habitat for upland game birds, such as ring-necked pheasant. Because it is near the Columbia River, this unit, especially the cropland, is utilized by waterfowl.

Runoff is slight. The hazard of soil blowing is high. Sediment from runoff is low. A maximum plant cover on rangeland and timely seeding, cultivation, and irrigation minimize the hazard of erosion.

3. Prosser

Moderately deep, well drained silt loams

This map unit consists of soils on nearly level terraces and rolling to hilly uplands. The soils formed in loess over basalt bedrock. The vegetation is needleandthread, bluebunch wheatgrass, and rabbitbrush. The elevation ranges from 300 to 600 feet. The average annual precipitation is 7 to 9 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 140 to 180 days at 32 degrees F. and 180 to 215 days at 28 degrees.

This unit makes up about 2 percent of the survey area. It is about 50 percent Prosser soils, 35 percent Quinton soils and Rock outcrop, and 15 percent Taunton, Warden, and Gravden soils.

Prosser soils, on bedrock terraces, are well drained. They have a surface layer of very dark grayish brown silt loam and a subsoil of dark brown silt loam. Depth to bedrock is 20 to 40 inches.

This unit is used mainly for range. A few areas are irrigated and used for pasture. The unit is also used for wildlife habitat. It supports small populations of mule deer. Birds and small mammals are common. In areas of irrigated crops, the unit provides habitat for upland game birds, such as ring-necked pheasant. The Rock outcrop and the steeper slopes along the Columbia River provide habitat for chukar. Because the unit is near the Columbia River, it provides habitat for an abundant variety of waterfowl.

Runoff is slight, and sediment from runoff is low. A maximum plant cover on rangeland, proper irrigation, and good stands in irrigated pasture minimize the hazard of erosion.

4. Sagehill-Taunton

Moderately deep and very deep, well drained and somewhat excessively drained fine sandy loams

This map unit is on terraces and terrace fronts. The soils formed in loess over lacustrine silt or a hardpan. The vegetation is bluebunch wheatgrass, needleandthread, Indian ricegrass, shrubs, and forbs. The elevation ranges from 500 to 1,200 feet. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is about 50 degrees F. The frost free period is 150 to 200 days at 32 degrees F. and 180 to 215 days at 28 degrees.

This unit makes up about 6 percent of the survey area. It is about 55 percent Sagehill soils, 15 percent Taunton soils, 20 percent Royal soils and Dune land, and 10 percent Ellum, Irrigon, Quincy, and Warden soils, and Xeric Torriorthents.

Sagehill soils, on terraces, are well drained. They have a surface layer of dark grayish brown fine sandy loam and a subsoil of dark brown fine sandy loam. Stratified lacustrine silt loam is at a depth of 20 to 40 inches. Depth to bedrock is more than 60 inches.

Taunton soils, also on terraces, are well drained. They have a surface layer of dark grayish brown fine sandy loam and a subsoil of dark brown fine sandy loam. A hardpan is at a depth of 20 to 40 inches.

This unit is used for range and wildlife habitat and, where irrigated, for pasture, hay, small grain, corn, and potatoes. It supports small populations of mule deer. Birds and small mammals are common. In areas of irrigated crops and along the major bottom lands, it provides habitat for upland game birds, such as ring-necked pheasant and valley quail. The scattered steeper canyon breaks throughout this unit provide habitat for chukar.

Runoff is medium on the steeper slopes and slight elsewhere. Sediment from runoff is low to moderate. Soil blowing is a moderate hazard. A maximum plant cover on rangeland and timely seeding, cultivation, and irrigation minimize the hazard of erosion.

5. Warden

Very deep, well drained silt loams and very fine sandy loams

This map unit is on terraces. The soils formed in loess over lacustrine silt. The vegetation is bluebunch wheatgrass, Sandberg bluegrass, shrubs, and forbs. The elevation ranges from 500 to 1,200 feet. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is about 51 degrees F. The frost free period is 140 to 180 days at 32 degrees F. and 180 to 215 days at 28 degrees.

This unit makes up about 5 percent of the survey area. It is about 90 percent Warden soils and 10 percent Ritzville, Sagehill, and Gravden soils, and Xeric Torriorthents.

Warden soils, on terraces, are well drained. They have a surface layer of dark brown silt loam or very fine sandy loam, a subsoil of brown silt loam, and a substratum of brown, strongly calcareous silt loam or very fine sandy loam. Depth to bedrock is more than 60 inches.

This unit is used for dryfarmed small grain, range, and wildlife habitat. Where irrigated, small grain, hay, and potatoes are grown. Birds and an assortment of small mammals are common. The unit supports small populations of mule deer. Along the major bottom lands, it provides habitat for game birds, such as ring-necked pheasant and valley quail. The scattered steeper canyon breaks throughout the unit provide habitat for chukar.

Runoff is mainly from the steep terrace fronts. Sediment from runoff is low to moderate. Stubble mulch tillage, stripcropping, and diversions on dryfarmed cropland, timely irrigation, and a maximum plant cover on rangeland minimize the hazard of erosion.

6. Xeric Torriorthents-Kimberly

Very deep, well drained and somewhat excessively drained sandy loams

This map unit consists of soils formed in recent mixed alluvium on stream bottoms. In areas that are not cultivated, the vegetation is giant wildrye shrubs, and forbs. The elevation ranges from 200 to 1,200 feet. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 51 to 53 degrees F. The frost free period is 140 to 180 days at 32 degrees F. and 180 to 200 days at 28 degrees.

This unit makes up about 1 percent of the survey area. It is about 50 percent Xeric Torriorthents, 40 percent Kimberly soils, and 10 percent Esquatzel soils.

Xeric Torriorthents soils, on stream bottoms, are somewhat excessively drained. They have a surface layer of dark brown sandy loam. The underlying material is dark brown fine sandy loam over dark grayish brown gravelly sandy loam and very gravelly loamy sand. Depth to bedrock is more than 60 inches.

Kimberly soils, on stream bottoms, are well drained. They have a surface layer of dark brown fine sandy loam and a subsoil and substratum of moderately calcareous, brown and dark grayish brown sandy loam. Depth to bedrock is more than 60 inches.

Most of this unit is irrigated. It is used for alfalfa hay and aftermath grazing. It provides good food cover for upland game birds, such as ring-necked pheasant and valley quail. This unit and the adjacent slopes provide habitat for chukar. It also provides food and limited cover for mule deer and smaller mammals.

Streambanks should be shaped properly and stabilized to minimize the hazards of bank cutting and the sediment pollution of streams during heavy runoff.

Areas dominated by shallow to very deep, well drained and somewhat excessively drained soils

These soils are on stream bottoms and the tops and sides of ridges throughout the central part of the survey area. Nearly all are well drained. Water erosion is a hazard in most areas.

Many of the soils are farmed, mostly in a grain-fallow rotation.

Seven map units are in this group.

7. Onyx-Endersby

Very deep, well drained and somewhat excessively drained silt loams and fine sandy loams

This map unit consists of soils formed in recent mixed alluvium on stream bottoms. In areas that are not cultivated, the vegetation is giant wildrye grass and bluebunch wheatgrass. If drainage is restricted, it is saltgrass. The elevation ranges from 1,000 to 2,500 feet. The average annual precipitation is 12 to 13 inches, and the average annual air temperature is about 50 degrees F. The frost free period is 130 to 170 days at 32 degrees F. and 170 to 210 days at 28 degrees.

This map unit makes up about 1 percent of the survey area. It is about 35 percent Onyx soils, 30 percent Endersby soils, 20 percent Pedigo soils, and 15 percent Snow soils.

Onyx soils, on stream bottoms, are well drained. They have a surface layer of very dark brown silt loam. The underlying layers are very dark brown very fine sandy loam and very dark grayish brown very fine sandy loam over very gravelly sandy loam. Depth to bedrock is more than 60 inches.

Endersby soils, also on stream bottoms, are somewhat excessively drained. They have a surface layer of dark brown fine sandy loam over dark brown and very dark grayish brown fine sandy loam. Depth to bedrock is more than 60 inches.

Most of this unit is irrigated. It is used for alfalfa hay and aftermath grazing. It provides good food and cover for upland game birds, such as ring-necked pheasant and valley quail. This unit and the adjacent slopes provide habitat for chukar. It also provides food and limited cover for mule deer and smaller mammals.

Streambanks should be properly shaped and stabilized to minimize the hazards of bank cutting and the sediment pollution of streams during heavy runoff.

8. Ritzville-Mikkalo-Willis

Moderately deep and very deep, well drained silt loams

This map unit consists of soils formed in loess on uplands. In areas that are not cultivated, the vegetation is bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, shrubs, and forbs. The elevation ranges from 1,000 to 2,500 feet. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees F. and 150 to 200 days at 28 degrees.

This unit makes up about 18 percent of the survey area. It is about 60 percent Ritzville soils, 20 percent Mikkalo soils, 10 percent Willis soils, and 10 percent Gravden, Bakeoven, and Lickskillet soils.

Ritzville soils, on the tops and sides of ridges and dominantly on north-facing slopes, are well drained. They have a surface layer of dark brown silt loam, a subsoil of dark brown and brown silt loam, and a substratum of calcareous, brown silt loam. Depth to bedrock is more than 60 inches.

Mikkalo soils, on ridgetops and dominantly south-facing slopes, are well drained. They have a surface layer of dark brown silt loam, a subsoil of brown silt loam, and a substratum of calcareous, pale brown silt loam. Depth to basalt bedrock is 20 to 40 inches.

Willis soils, on smooth and slightly concave ridgetops, are well drained. They have a surface layer of dark brown silt loam, a subsoil of brown silt loam, and a substratum of calcareous, brown silt loam. A lime-silica cemented hardpan is at a depth of 20 to 40 inches.

This unit is used mainly for wheat and barley in a grain-summer fallow system. Areas too steep for cultivation are used for range. A few irrigated areas produce wheat and beans.

This unit provides food and cover for mule deer and smaller mammals. The major bottom lands throughout this unit provide food and cover for upland game birds, such as ring-necked pheasant and valley quail. The steeper breaks and areas along creeks provide suitable habitat for chukar.

Runoff is a problem from all but the more nearly level areas. Sediment from runoff is moderate to high. Stubble mulch tillage, stripcropping, and diversions in cropped areas and a maximum plant cover on rangeland minimize the hazard of erosion.

9. Lickskillet-Wrentham

Shallow and moderately deep, well drained very stony loams and silt loams

This map unit consists of soils formed in loess mixed with colluvium from basalt. These soils are on steep north-facing slopes and gently sloping to steep south-facing slopes. The vegetation is bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, shrubs, and forbs. The elevation ranges from 1,000 to 3,500 feet. The average annual precipitation is 10 to 14 inches, and the average annual air temperature is about 49 degrees F. The frost-free period is 60 to 150 days at 32 degrees F. and 100 to 210 days at 28 degrees.

This unit makes up about 1 percent of the survey area. It is about 45 percent Lickskillet soils, 30 percent Wrentham soils, 10 percent Nansene soils, and 15 percent Mikkalo, Ritzville, Bakeoven, Valby, Rhea, and Morrow soils.

Lickskillet soils, generally on south-facing slopes, are well drained. They have a surface layer of very dark grayish brown very stony loam and a subsoil of dark brown very cobbly loam. Depth to basalt bedrock is 12 to 20 inches.

Wrentham soils, on steep north-facing slopes, are well drained. They have a surface layer of very dark brown silt loam and a subsoil of very gravelly silt loam. Depth to basalt bedrock is 20 to 40 inches.

This unit is used for range and wildlife habitat. The steep slopes in this unit along with the adjacent bottom land unit provide good habitat for chukar and other upland game birds, such as ring-necked pheasant and valley quail. Mule deer use the Wrentham part of this unit in summer and fall because of the cooler temperatures and proximity to cover. The Lickskillet part of this unit is used in spring and winter because of the warmer temperatures and proximity to cover. A variety of smaller mammals are also common.

The hazard of erosion is high. Sediment from runoff is low to moderate. Maintaining maximum plant cover on rangeland minimizes the hazard of erosion.

10. Valby-Lickskillet-Bakeoven

Very shallow to moderately deep, well drained silt loams, very stony loams, and very cobbly loams

This map unit is on the ridgetops and sides of ridges. The soils formed in loess and colluvium from basalt. In areas that are not cultivated the vegetation is bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, shrubs, and forbs. The elevation ranges from 1,400 to 3,500 feet. The average annual precipitation is 10 to 14 inches, and the average annual air temperature is 48 to 52 degrees F. The frost free period is 100 to 150 days at 32 degrees F. and 150 to 210 days at 28 degrees.

This unit makes up 5 percent of the survey area. It is about 45 percent Valby soils, 35 percent Lickskillet soils (fig. 1), 15 percent Bakeoven soils, and 5 percent Rhea, Nansene, and Wrentham soils.

Valby soils, on the tops and sides of ridges, are well drained. They have a surface layer of very dark grayish brown silt loam, a subsoil of very dark grayish brown and dark brown silt loam, and a substratum of dark brown, calcareous silt loam. Depth to basalt bedrock is 20 to 40 inches.

Lickskillet soils, generally on south-facing slopes, are well drained. They have a surface layer of very dark grayish brown very stony loam and a subsoil of dark brown very cobbly loam. Depth to basalt bedrock is 12 to 20 inches.

Bakeoven soils, on ridgetops, are well drained. They have a thin surface layer of dark brown very cobbly loam and a subsoil of dark brown very cobbly loam. Depth to basalt bedrock is 5 to 12 inches.

This unit is used for wheat and barley in a crop-fallow system. It is also used for range and wildlife habitat.

The unit provides food and cover for mule deer and smaller mammals. The bottom land and adjacent slopes provide good sources for food and cover for upland game birds, such as chukar, ring-necked pheasant, and valley quail.

Runoff is mainly from the steep slopes of Lickskillet soils and the steeper, dryfarmed slopes of Valby soils. Sediment from runoff is low to moderate. A maximum plant cover on rangeland and stubble mulch tillage,

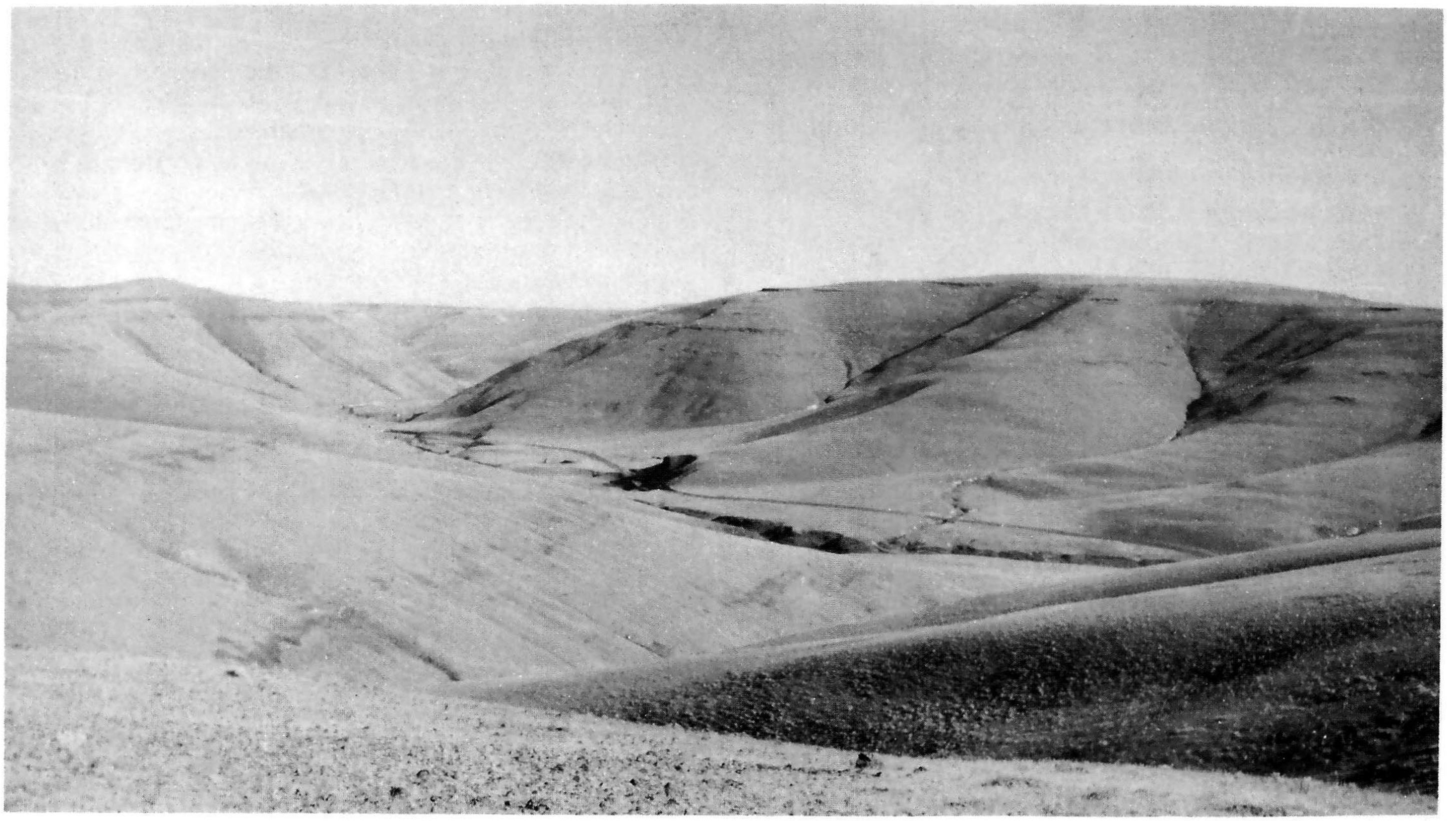


Figure 1.—Shallow very stony Lickskillet soils in left foreground. On the ridgetops are the moderately deep Valby soils

stripcropping, and diversions in dryfarmed cropland minimize the hazard of erosion.

11. Valby-Rhea

Moderately deep and very deep, well drained silt loams

This map unit consists of soils formed in loess on the tops and sides of ridges. In areas that are not cultivated, the vegetation is bluebunch wheatgrass, Idaho fescue, shrubs, and forbs. The elevation ranges from 1,600 to 3,200 feet. The average annual precipitation is 10 to 14 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free period is 100 to 150 days at 32 degrees F. and 150 to 200 days at 28 degrees.

This unit makes up 10 percent of the survey area. It is about 40 percent Valby soils, 20 percent Rhea soils, 30 percent Bakeoven and Lickskillet soils, and 10 percent Nansene and Wrentham soils.

Valby soils, on the tops and sides of ridges, are well drained. They have a surface layer of very dark grayish brown silt loam, a subsoil of very dark grayish brown and dark brown silt loam, and a substratum of calcareous, dark brown silt loam. Depth to basalt bedrock is 20 to 40 inches.

Rhea soils, on ridgetops and mainly north-facing slopes, are well drained. They have a surface layer of very dark brown and very dark grayish brown silt loam, a subsoil of dark brown silt loam, and a substratum of calcareous, dark brown silt loam. Depth to basalt bedrock is more than 60 inches.

This unit is used almost entirely for wheat and barley in a crop-fallow system. It is also used for wildlife habitat.

This unit provides food and cover for mule deer and smaller mammals. The major bottom lands throughout the unit provide food and cover for upland game birds, such as ring-necked pheasant and valley quail. The steeper breaks and areas along drainageways provide suitable habitat for chukar.

Runoff is mainly from steeper dryfarmed areas. Sediment from runoff is moderate to high. Stubble mulch tillage, stripcropping, and diversions in cropped areas and a maximum plant cover on rangeland minimize the hazard of erosion.

12. Morrow-Lickskillet-Bakeoven

Very shallow to moderately deep, well drained silt loams, very stony loams, and very cobbly loams

This map unit consists of soils formed in loess and colluvium from basalt. It is on the tops and sides of ridges. In areas that are not cultivated, the vegetation is bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, shrubs, and forbs. The elevation ranges from 2,000 to 3,500 feet. The average annual precipitation is 11 to 16 inches, and the mean annual air temperature is 46 to 53 degrees F. The frost free period is 110 to 150 days at 32 degrees F. and 150 to 210 days at 28 degrees.

This unit makes up 7 percent of the survey area. It is about 40 percent Morrow soils, 35 percent Lickskillet soils, 20 percent Bakeoven soils, and 5 percent Wrentham soils.

Morrow soils, on the tops and sides of ridges, are well drained. They have a surface layer of very dark brown silt loam, a subsoil of dark brown silty clay loam, and a substratum of calcareous, dark brown silt loam. Depth to basalt is 20 to 40 inches.

Lickskillet soils, generally on south-facing slopes, are well drained. They have a surface layer of very dark grayish brown very cobbly loam and a subsoil of dark brown very cobbly loam. Depth to basalt is 12 to 20 inches.

Bakeoven soils, on ridgetops, are well drained. They have a thin surface layer of dark brown very cobbly silt loam and a subsoil of dark brown very cobbly silty clay loam. Depth to basalt is 4 to 12 inches.

This unit is used for wheat and barley in a crop-fallow system. It is also used for range and wildlife habitat.

This unit provides food and cover for mule deer and smaller mammals. The major bottom lands throughout this unit provide food and cover for upland game birds, such as ring-necked pheasant and valley quail. The steeper breaks and areas along drainageways provide suitable habitat for chukar.

Runoff is mainly from the steeper dryfarmed areas of Morrow soils and steeper areas of Lickskillet soils. Sediment from runoff is moderate. Stubble mulch tillage, stripcropping, and diversions in cropped areas and a maximum plant cover on rangeland minimize the hazard of erosion.

13. Morrow

Moderately deep, well drained silt loams

This map unit consists of soils formed in loess. It is on the tops and sides of ridges. In areas that are not cultivated, the vegetation is bluebunch wheatgrass, Idaho fescue, shrubs, and forbs. The elevation ranges from 2,200 to 3,500 feet. The average annual precipitation is 12 to 16 inches, and the average annual air temperature is 46 to 50 degrees F. The frost free period is 110 to 150 days at 32 degrees F. and 150 to 200 days at 28 degrees.

This unit makes up 4 percent of the survey area. It is about 80 percent Morrow soils and 20 percent Lickskillet, Bakeoven, and Wrentham soils.

Morrow soils, on the tops and sides of ridges, are well drained. They have a surface layer of very dark brown silt loam, a subsoil of dark brown silty clay loam, and a substratum of calcareous, dark brown silt loam. Depth to basalt bedrock is 20 to 40 inches.

This unit is used for wheat and barley in a crop-fallow system. It is also used for range and wildlife habitat.

This unit provides food and cover for mule deer and smaller mammals. The steeper slopes that dissect the unit provide good sources of food and cover for chukar and other game birds.

Runoff is mainly from steeper dryfarmed areas and from overgrazed rangeland. Stubble mulch tillage, stripcropping, and diversions in dryfarmed areas and a maximum plant cover on rangeland minimize the hazard of erosion.

Areas dominated by shallow to very deep, well drained soils

These soils are in the southern part of Morrow County, mainly on plateaus and peaks dissected by deep, steep walled canyons. The slope range is 0 to 75 percent. The elevation ranges from 2,200 to 6,000 feet. The average annual precipitation is 13 to 30 inches. Erosion is a major hazard.

Except for two areas that are used mainly for dryfarmed crops and irrigated hay and pasture, the soils are used for timber and range. Ponderosa pine and Douglas-fir are the principal trees. These soils are a major source of water supply.

Five map units are in this group.

14. Waha-Waterbury-Rockly

Very shallow to moderately deep, well drained silt loams, extremely stony silt loams, and very gravelly loams

This map unit consists of soils formed in loess and in colluvium and residuum from basalt. In areas that are not cultivated, the vegetation is Idaho fescue, bluebunch wheatgrass, Sandberg bluegrass, shrubs, and forbs. The elevation ranges from 2,600 to 4,300 feet. The average annual precipitation is 14 to 30 inches, and the average annual air temperature is 46 to 49 degrees F. The frost free period is 80 to 150 days at 32 degrees F. and 120 to 170 days at 28 degrees.

This unit makes up 12 percent of the survey area. It is about 45 percent Waha soils, 30 percent Waterbury soils, 15 percent Rockly soils, and 10 percent Snell and Klicker soils.

Waha soils, on ridgetops and mainly north-facing slopes, are well drained. They have a surface layer of black silt loam and a subsoil of dark brown silty clay loam. Depth to basalt is 20 to 40 inches.

Waterbury soils, on south-facing slopes, are well drained. They have a surface layer of black very cobbly silt loam and a subsoil of dark brown cobbly clay. Depth to basalt is 12 to 20 inches.

Rockly soils, on ridgetops, are well drained. They have a thin surface layer of very dark grayish brown very gravelly silt loam and a subsoil of dark brown very gravelly silt loam. Depth to basalt is 5 to 12 inches.

This unit is used for wheat and barley in a crop-fallow system. It is also used for range and wildlife habitat.

This unit provides food and cover for mule deer and smaller mammals. The major bottom lands throughout this unit provide food and cover for upland game birds, such as ring-necked pheasant and valley quail. The steeper breaks provide suitable habitat for chukar.

Runoff is mainly from steeper dryfarmed areas of Waha soils and steeper areas of Waterbury soils. Stubble mulch tillage and diversions in dryfarmed areas and a maximum plant cover on rangeland minimize the hazard of erosion.

15. Hankins-Klicker-Boardtree

Moderately deep and very deep, well drained silt loams and stony silt loams

This map unit consists of soils formed in clayey sediment, in volcanic ash, in loess, and in colluvium and residuum from basalt. The vegetation is sedges, shrubs, grasses, Douglas-fir, ponderosa pine, and grand fir. The elevation ranges from 3,500 to 4,600 feet. The average annual precipitation is 18 to 25 inches, and the average annual air temperature is 42 to 45 degrees F. The frost free period is 30 to 90 days at 32 degrees F. and 80 to 110 days at 28 degrees.

This unit makes up 4 percent of the survey area. It is about 30 percent Hankins soil, 25 percent Klicker soils, 20 percent Boardtree soils, and 25 percent Bocker, Hall Ranch, and Tolo soils and Aquolls and Aquepts.

Hankins soils, generally on south-facing slopes, are well drained. They have a surface layer of very dark gray and very dark grayish brown silt loam, a subsoil of dark brown and yellowish brown clay, and a substratum of yellowish brown and light yellowish brown clay loam. Depth to bedrock is more than 60 inches.

Klicker soils, on ridgetops and south-facing slopes, are well drained. They have a surface layer of dark reddish brown stony silt loam and a subsoil of dark reddish brown and dark brown very cobbly silty clay loam. Depth to basalt is 20 to 40 inches.

Boardtree soils, on north-facing slopes, are well drained. They have a surface layer of dark brown loam, a subsoil of brown loam, and substratum of brown clay and clay loam. Depth to bedrock is more than 60 inches.

This unit is used for timber, range, recreation, and wildlife habitat. It supports large populations of mule deer and Rocky Mountain elk. Game birds, such as blue and ruffed grouse, are common.

Runoff is mainly from the steep and very steep soils, particularly in recently logged areas. Sediment from runoff is low to moderate. The most serious concern in erosion control after logging is on the ashy Boardtree soils. Soil and water conservation in such areas minimizes the hazard of erosion.

16. Klicker-Bocker-Hall Ranch

Very shallow and moderately deep, well drained stony silt loams, loams, and extremely cobbly silt loams

This map unit consists of soils formed in loess and small amounts of volcanic ash and in colluvium and residuum from basalt and andesite. The vegetation is sedges, shrubs, grasses, Douglas-fir, ponderosa pine, and grand fir. The elevation ranges from 3,500 to 4,600 feet. The average annual precipitation is 18 to 25 inches, and the average annual air temperature is 42 to 45 degrees F. The frost free period is 40 to 90 days at 32 degrees F. and 80 to 110 days at 28 degrees.

This unit makes up 3 percent of the survey area. It is about 35 percent Klicker soils, 20 percent Bocker soils, 15 percent Hall Ranch soils, and 30 percent Gwin, Hankins, Tolo, and Wrightman soils.

Klicker soils, on ridgetops and south-facing slopes, are well drained. They have surface layer of dark reddish brown stony silty loam and a subsoil of dark reddish brown and dark brown very cobbly silty clay loam. Depth to basalt bedrock is 20 to 40 inches.

Bocker soils, on narrow to broad ridgetops, are well drained. They have a surface layer of dark reddish brown extremely cobbly silt loam. Depth to basalt is 4 to 12 inches.

Hall Ranch soils, generally on broad ridgetops and south-facing slopes, are well drained. They have a surface layer of dark reddish brown loam and a subsoil of dark reddish brown loam. Depth to andesite bedrock is 20 to 40 inches.

This unit is used for timber, range, recreation, and wildlife habitat. It supports large populations of mule deer and Rocky Mountain elk. Game birds, such as blue and ruffed grouse, are common.

Runoff is mainly from the steep and very steep soils, particularly in recently logged areas. Sediment from runoff is low. Soil and water conservation in logged areas minimizes the hazard of erosion.

17. Tolo-Klicker-Hall Ranch

Moderately deep and very deep, well drained silt loams, stony silt loams, and loams

This map unit consists of soils formed in loess and volcanic ash and in colluvium and residuum from basalt and andesite. The vegetation is sedges, shrubs, grasses, Douglas-fir, ponderosa pine, grand fir, and western larch. The elevation ranges from 3,500 to 4,600 feet. The average annual precipitation is 18 to 25 inches, and the average annual air temperature is 42 to 45 degrees F. The frost free period is 30 to 90 days at 32 degrees F. and 60 to 110 days at 28 degrees.

This unit makes up 5 percent of the survey area. It is about 30 percent Tolo soils, 25 percent Klicker soils, 20 percent Hall Ranch soils, and 25 percent Boardtree, Bocker, Gwin, Hankins, Labuck, and Utley soils.

Tolo soils, on ridgetops and north-facing slopes, are well drained. They have a surface layer of very dark brown silt loam, a subsoil of yellowish brown and very pale brown silt loam, and a substratum of dark brown loam and very cobbly silty clay loam. Depth to bedrock is more than 60 inches.

Klicker soils, on ridgetops and south-facing slopes, are well drained. They have a surface layer of dark reddish brown stony silt loam and a subsoil of dark reddish brown and dark brown very cobbly silty clay loam. Depth to basalt is 20 to 40 inches.

Hall Ranch soils, generally on broad ridgetops and south-facing slopes, are well drained. They have a surface layer of dark reddish brown loam and a subsoil of dark reddish brown loam. Depth to andesite bedrock is 20 to 40 inches.

This unit is used for timber, range, recreation, and wildlife habitat. It supports large populations of mule deer and Rocky Mountain elk. Game birds, such as blue and ruffed grouse, are common.

Runoff is mainly from the steep and very steep soils, particularly in recently logged areas. Sediment from runoff is low to moderate. The hazard of erosion after logging is most severe on the ashy Tolo soils. Soil and water conservation in such areas minimizes the hazard of erosion.

18. Helter-Klicker-Hall Ranch

Moderately deep and deep, well drained silt loams, stony silt loams, and loams

This map unit consists of soils formed in loess and volcanic ash and in colluvium and residuum from basalt and andesite. The vegetation is sedges, shrubs, grasses, Douglas-fir, ponderosa pine, grand fir, western larch, and lodgepole pine. The elevation ranges from 4,600 to 6,000 feet. The average annual precipitation is 24 to 30 inches, and the average annual air temperature is 40 to 43 degrees F. The frost free period is 20 to 60 days at 32 degrees F. and 50 to 80 days at 28 degrees.

This unit makes up 7 percent of the survey area. It is about 65 percent Helter soils, 20 percent Klicker soils, 10 percent Hall Ranch soils, and 5 percent Bocker and Labuck soils and Aquepts and Aquolls.

Helter soils, on ridgetops and north-facing slopes, are well drained. They have a surface layer of brown silt loam, a subsoil of yellowish brown and light yellowish brown loam and silt loam, and a substratum of yellowish brown loam and very gravelly loam. Depth to basalt or granitic bedrock is 40 to 60 inches.

Klicker soils, on ridgetops and south-facing slopes, are well drained. They have a surface layer of dark reddish brown stony silt loam and a subsoil of dark reddish brown and dark brown very cobbly silty clay loam. Depth to basalt is 20 to 40 inches.

Hall Ranch soils, generally on broad ridgetops and south-facing slopes, are well drained. They have a surface layer of dark reddish brown loam and a subsoil of dark reddish brown loam. Depth to andesite bedrock is 20 to 40 inches.

This unit is used for timber, range, recreation, and wildlife habitat. It supports large populations of mule deer and Rocky Mountain elk. Game birds, such as blue and ruffed grouse, are common.

Runoff is mainly from the steep and very steep soils, particularly in recently logged areas. Sediment from runoff is low to moderate. The most serious concern in erosion control after logging is on the ashy Tolo soils. Soil and water conservation in such areas minimizes the hazard of erosion.

Broad land use considerations

Irrigated farming in the northern part of the survey area is the most recent change in land use. See map units 1, 2, 3, and 4 on the general soil map at the back of this publication. Before the availability of irrigation water and the development of the center pivot irrigation system, the droughty sandy soils in map units 1, 2, and 4 were suitable only for limited winter grazing. Under irrigation, they are well suited to many vegetable, grain, hay, and specialty crops. A large acreage is developed for irrigation each year, and the trend is expected to continue so long as Columbia River water is available and electric power is available to pump it at an economically feasible rate.

Some soils in map units 2 and 4 are underlain by bedrock or a hardpan within a depth of 40 inches. If these soils or the soils to the north are overirrigated, they readily develop a high water table. This problem has occurred in the areas south of Boardman and near Irrigon.

With the increase of irrigated farming in the Boardman and Irrigon areas and the development of electric power plants near Boardman, the population in the northern part of Morrow County is expected to increase significantly. Industrial activity, especially the processing of farm products, is also expected to increase. The soils in map units 1, 2, 3, and 4 are generally well suited to community uses. The soils in units 1, 2, and 4, however, are subject to blowing and related damage caused by drifting sand, for example, blockage of roads and streets and sandblasting of homes and buildings. In addition, for the soils in units 1, 2, 3, and 4 that are moderately deep over bedrock or a hardpan, some design modification is needed for sanitary facilities.

The soils in unit 5 and the deep soils in unit 8 have good potential for a large variety of crops under irrigation. Some areas are now irrigated from deep wells, and some with water pumped from the Columbia River. The irrigation of extensive areas in units 5 and 8 depends on an adequate available water supply at an economically feasible cost, especially from the Columbia River.

Approximately 50,000 acres in map units 2, 4, and 5 is within the Boardman Bombing Range, a U. S. Naval Reservation. This acreage is available only for limited winter livestock grazing.

Until an adequate supply of water is available for irrigation, no major change in land use is expected on the arable soils in map units 5, 8, 10, 11, 12, 13, and 14.

The nearly level areas of the deeper soils in units 8 and 11 are well suited to most community and recreation uses. They will probably continue to be used for grain-fallow cropping. The soils in unit 9 are steep and rocky and are poorly suited to any use other than their present use, which is rangeland and wildlife habitat.

Map units 6 and 7 are mainly on flood plains along streams in the area north of the Blue Mountains—Willow Creek, Rhea Creek, Butter Creek, and Sand Hollow. Nearly all these soils are deep and well drained, but they are subject to rare flooding and are not considered well suited to community and sanitary facilities. Almost the entire acreage of the Kimberly and Esquatzel soils in unit 6 is irrigated and is well suited to a wide variety of crops. At present, however, these soils are used mainly for alfalfa hay and pasture. The Xeric Torriorthents in unit 6 are used mostly for range. If irrigation water becomes available, they could be used for a wide variety of crops.

The soils in unit 7 are well suited to a variety of crops under irrigation, but they are used almost entirely for irrigated alfalfa hay and pasture. The Snow soils in unit 6 have a shorter growing season than other soils in the unit, and in some areas they lack a reliable source of irrigation water.

Map units 15, 16, 17, and 18 are mainly wooded. About two-thirds of the acreage in these units is National Forest. The chief uses are timber production, livestock grazing, and recreation. No major change in land use seems likely in the near future, but with the increase in population, the acreage used for recreation is expected to increase. The number of seasonal recreation cabins is increasing on privately owned land, which is about one-third the acreage in these map units. The need for camp grounds and parks on National Forest land and possibly on private land is also increasing. On most soils in units 15, 16, 17, and 18, limitations are severe for sanitary facilities and dwellings. Design modification is needed. Avoiding the steep slopes greatly lessens these limitations.

Soil maps for detailed planning

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Ritzville silt loam, 2 to 7 percent slopes, is one of several phases in the Ritzville series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Bakeoven-Valby complex, 2 to 20 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Aquepts and Aquolls, nearly level, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Dune land is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil descriptions

1—Aquepts and Aquolls, nearly level. This map unit consists of very deep, poorly drained soils formed in loess, volcanic ash, and alluvium. Aquolls are mainly along major drainageways in the forest. Aquepts are generally in mountain meadows. This pattern is fairly consistent, but it is also common to find both soils along drainageways or in meadows (fig. 2).

The elevation is 3,500 to 5,100 feet. The average slope is 2 percent. The mean annual precipitation is 20 to 28 inches, and the mean annual air temperature is 42 to 45 degrees F. The frost free period is 30 to 60 days at 32 degrees and 80 to 110 days at 28 degrees.

Aquepts have a silt loam surface layer. The upper 15 inches is black and very dark brown. The lower 12 inches is grayish brown. The subsoil is black and dark brown silty clay loam and silty clay about 17 inches thick. The substratum is silty clay loam. The upper 7 inches is dark grayish brown. The lower 9 inches is dark greenish gray.

Aquolls have a surface layer of black silt loam about 3 inches thick. The subsoil is black and very dark gray silty clay loam about 35 inches thick. The substratum is very

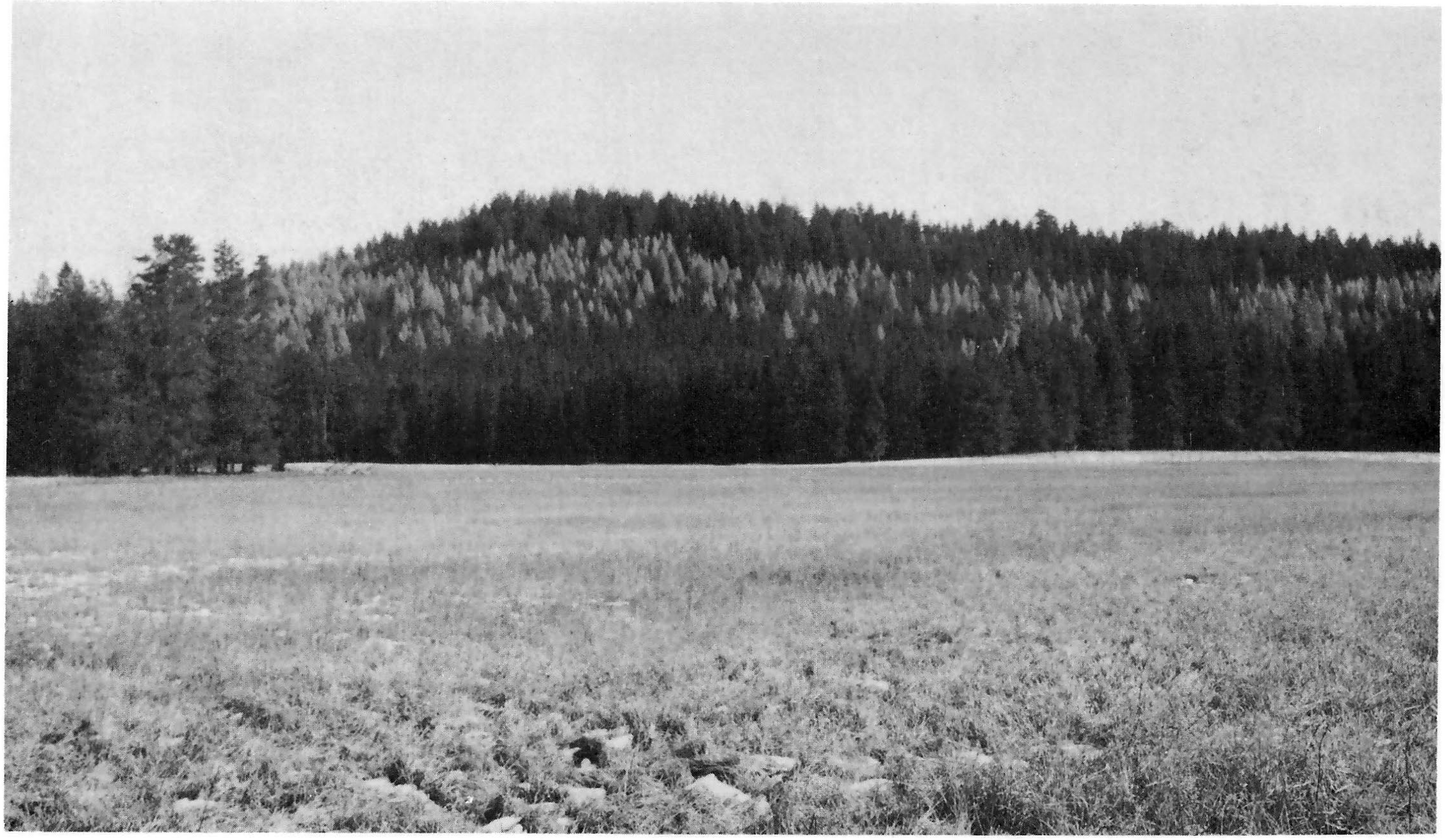


Figure 2.—Mountain meadow of poorly drained Aquepts and Aquolls, nearly level Helter silt loam, 15 to 35 percent slopes, is in the background.

dark gray and very dark grayish brown silty clay about 22 inches thick.

About 20 percent of this unit is included areas of similar soils that are less than 60 inches thick. About 2 percent is Boardtree and Helter soils.

Permeability is very slow. Available water capacity is 9 to 13 inches. Water supplying capacity is 10 to 14 inches. Effective rooting depth is 30 to 50 inches. Runoff is slow, and the hazard of water erosion is slight.

These soils are used for range, recreation, and wildlife habitat.

The native vegetation is a wet meadow plant community dominated by tufted hairgrass. Redtop, Kentucky bluegrass, Nebraska sedge, and a variety of forbs are prominent throughout the stand.

If range condition deteriorates, the proportion of tufted hairgrass decreases and the proportion of sedge and sodforming grasses, such as redtop and Kentucky bluegrass, increases. If deterioration is severe, forbs are abundant and the plant community becomes weedy. As a result, the sod cover is broken in places and erosion channels form.

If the range is in poor condition and excess water can be controlled, complete meadow renovation including seedbed preparation and seeding is practical. Reed canarygrass, meadow foxtail, tall fescue, and alsike clover are suitable for seeding. Vegetation along streams and water courses, if left undisturbed, provides valuable streambank protection and wildlife cover. This unit supports large populations of mule deer and Rocky Mountain elk.

Roads built on this unit require a maximum amount of ballast if they are to be used during wet periods. The subgrade material is poor. Driving off-road vehicles should be avoided when these soils are wet.

Because of the seasonally high water table, high shrink-swell potential, and low strength, all community and recreation uses are severely limited.

The capability subclass is Vw.

2D—Bakeoven very cobbly loam, 2 to 20 percent slopes. This is a very shallow, well drained soil (fig. 3) formed in loess and residuum from basalt. It is on ridgetops at elevations of 1,600 to 3,500 feet. The average slope is 5 percent. The average annual precipitation is 10 to 14 inches, and the average annual air temperature is 48 to 52 degrees F. The frost free period is 110 to 140 days at 32 degrees and 140 to 180 days at 28 degrees.

In a representative profile the surface layer is dark brown very cobbly loam about 2 inches thick. The subsoil is dark brown extremely cobbly loam about 5 inches thick. Basalt is at a depth of about 7 inches.

About 10 percent of this unit is included areas of Lickskillet soils and 5 percent is Morrow and Valby soils.

Permeability is moderately slow. Effective rooting depth is 4 to 12 inches. Available water capacity is 0.5 to 1.5 inches. Water supplying capacity is less than 2.5 inches. Runoff is slow to medium, and the hazard of erosion is moderate.

This soil is used for livestock grazing and wildlife habitat.

The major concern is maintaining an adequate plant cover for control of water erosion.

The native plant community is dominated by very shallow rooted plants, principally Sandberg bluegrass. Stiff sagebrush occurs in varying amounts but generally is prominent. It is an important browse plant in areas where it is fairly abundant. Perennial forbs, such as serrated balsamroot, snow eriogonum, and phlox commonly occur in small amounts.

If range condition deteriorates, Sandberg bluegrass and stiff sagebrush decrease and the proportion of low value forbs increases. If deterioration is severe, most plants are nearly eliminated and a rock pavement forms.

Because the soil is very shallow and stony, seedbed preparation and range seeding are not practical.

Areas of this soil provide limited food and cover for mule deer, small mammals, and game birds and song birds.

The depth to bedrock and stoniness are limitations for community and recreation uses. Extensive design modifications are needed but in most places are not practical for dwellings, small buildings, and sanitary facilities.

The capability subclass is VIIs.

3D—Bakeoven-Morrow complex, 2 to 20 percent slopes. This map unit is on ridgetops at elevations of 2,200 to 3,500 feet. It is 40 to 60 percent the very shallow Bakeoven soil, 25 to 40 percent the moderately deep Morrow soil, and 10 percent Lickskillet soils. Both Bakeoven and Morrow soils formed in loess over basalt. Both are well drained. The unit occurs as patterned land, known locally as biscuit scabland (fig. 4). The Bakeoven soil occurs as scabland between and around areas of the Morrow soil. If the slope is less than 10 percent, the Morrow soil occurs as circular mounds, or biscuits, that have a convex surface and are deepest at the center. If

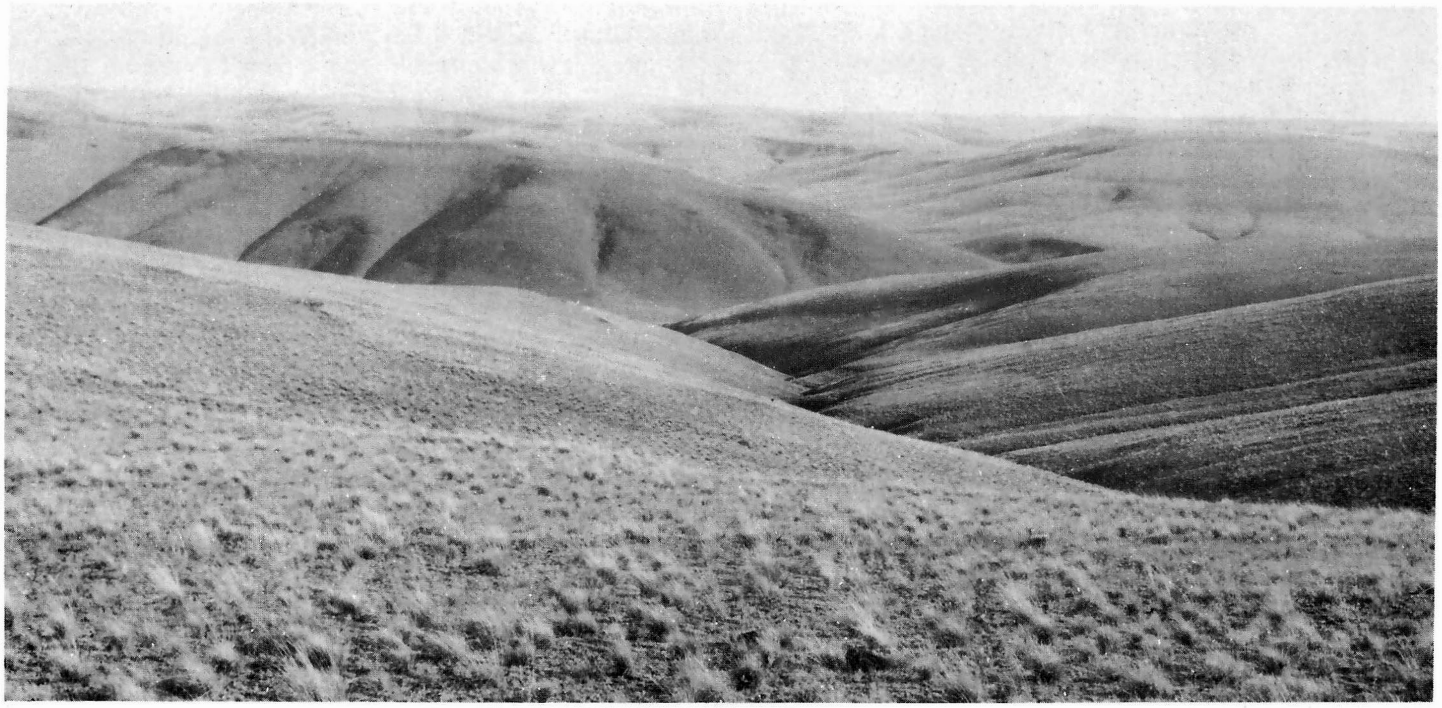


Figure 3.—Very shallow very cobbly Bakeoven soils in foreground.

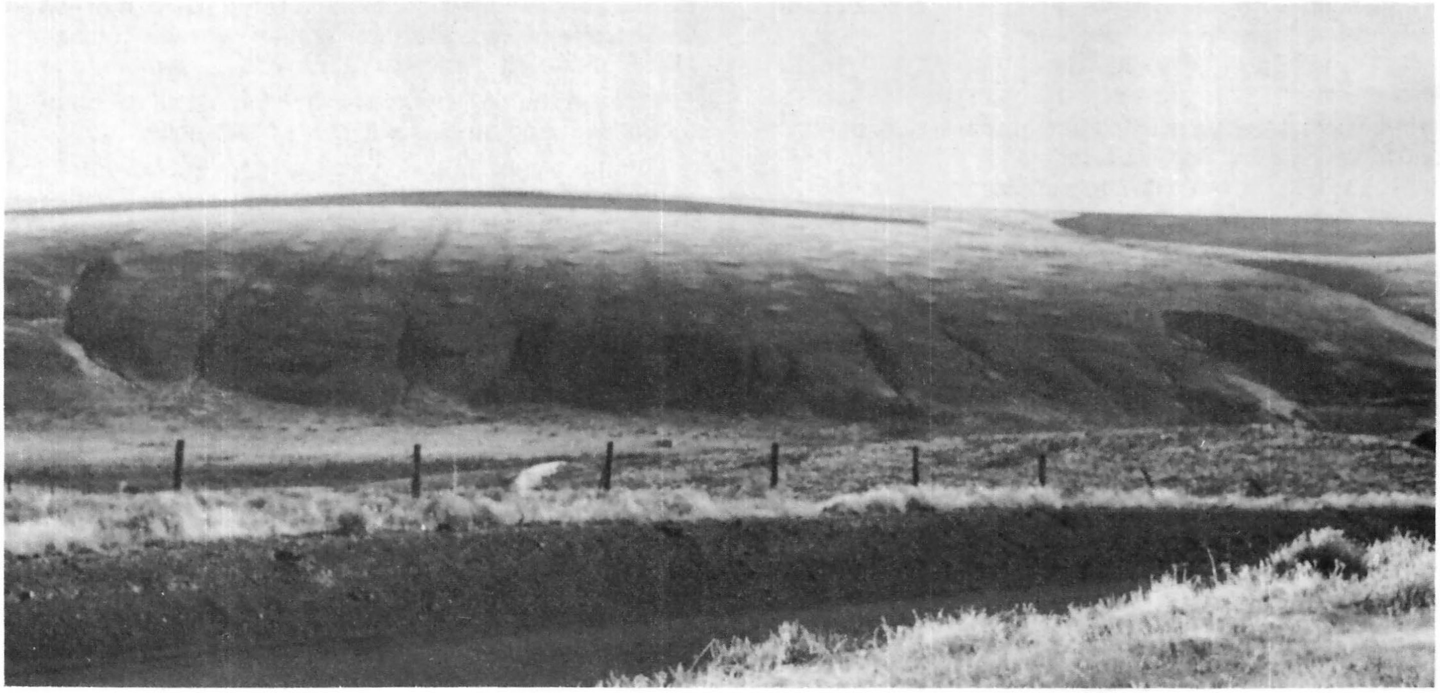


Figure 4.—Area of patterned land, locally known as biscuit scabland, in background. The deeper soils in the "biscuits" are Morrow silt loam. They are surrounded by Bakeoven very cobbly loam "scabland."

the slope is more than 10 percent, it occurs as long mounds, the long axis parallel with the slope. The circular mounds are 20 to 50 feet in diameter and 20 to 40 feet apart. The long mounds are 100 to 300 feet long and 30 to 60 feet wide.

The average slope is 5 percent. The average annual precipitation is 12 to 14 inches, and the average annual air temperature is 46 to 50 degrees F. The frost free period is 110 to 140 days at 32 degrees F. and 150 to 180 days at 28 degrees.

In a representative profile of Bakeoven very cobbly loam the surface layer is dark brown and is about 2 inches thick. The subsoil is dark brown extremely cobbly loam about 5 inches thick. Basalt is at a depth of about 7 inches.

In a representative profile of Morrow silt loam the surface layer is very dark brown and is about 9 inches thick. The subsoil is dark brown silty clay loam and silt loam about 10 inches thick. The substratum is dark brown silt loam about 7 inches thick. Fractured basalt is at a depth of about 26 inches.

The Bakeoven soil has moderately slow permeability. Effective rooting depth is 5 to 12 inches. Available water capacity is 0.5 to 1.5 inches. Water supplying capacity is less than 2.5 inches. Runoff is slow to medium, and the hazard of erosion is moderate.

The Morrow soil has moderately slow permeability. Effective rooting depth is 20 to 40 inches. Available water capacity is 4 to 8.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Nearly all the unit is used for livestock grazing and wildlife habitat.

The major concern in management is maintaining an adequate plant cover for control of water erosion.

On the Morrow soil, the native plant community is dominated by bluebunch wheatgrass. Idaho fescue, Sandberg bluegrass, and a variety of perennial forbs are prominent. Shrubs are minor. On the Bakeoven soil, the plant community is dominated by Sandberg bluegrass and varying amounts of stiff sagebrush. It also includes a few low growing perennial forbs.

If range condition deteriorates, the productive bunchgrasses decrease and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe, the stand of bunchgrass on the Morrow soils and the stand of stiff sagebrush on the Bakeoven soil are nearly eliminated. As a result, annual weeds and a few shrubs occupy the deeper Morrow soil and a rock pavement forms on the interspersed Bakeoven soil.

Because of interspersed areas of the very shallow and stony Bakeoven soil, range seeding generally is not practical.

Most areas of this unit provide food and limited cover for mule deer, small mammals, game birds, and song birds.

Stoniness and depth to bedrock are limitations for community and recreation uses on the Bakeoven soil. Extensive design modifications are needed but in most places are not practical for dwellings, small buildings, and sanitary facilities.

Depth to bedrock and moderately slow permeability are limitations for community uses on the Morrow soil. Design modifications are needed for dwellings, small buildings, and sanitary facilities.

The capability subclass is VIIs.

4D—Bakeoven-Valby complex, 2 to 20 percent slopes. This map unit is on ridgetops at elevations of 1,600 to 3,000 feet. It is 40 to 60 percent the very shallow Bakeoven soil, which formed in loess; 25 to 45 percent the moderately deep Valby soil, which formed in loess mixed with some ash; 10 percent Lickskillet soils; and 5 percent Rhea soils. Both Bakeoven and Valby soils formed over basalt. Both are well drained. This unit occurs as patterned land, known locally as biscuit scabland. The Bakeoven soil occurs as scabland between and around areas of the Valby soil. If the slope is less than 10 percent, the Valby soil occurs as circular mounds, or biscuits, that have a convex surface and are deepest at the center. If the slope is more than 10 percent, it occurs as long mounds, the long axis parallel with the slope. The circular mounds are 20 to 50 feet in diameter and 20 to 40 feet apart. The long mounds are 100 to 300 feet long and 30 to 60 feet wide.

The average slope is 5 percent. The average annual precipitation is 10 to 14 inches, and the average annual air temperature is 48 to 52 degrees F. The frost free period is 110 to 140 days at 32 degrees F. and 150 to 180 days at 28 degrees.

In a representative profile of Bakeoven very cobbly loam the surface layer is dark brown and is about 2 inches thick. The subsoil is dark brown extremely cobbly loam about 5 inches thick. Basalt is at a depth of about 7 inches.

In a representative profile of Valby silt loam the surface layer is very dark grayish brown and is about 8 inches thick. The subsoil is very dark grayish brown and dark brown heavy silt loam about 17 inches thick. The substratum is dark brown, calcareous silt loam about 5 inches thick. Basalt is at a depth of about 30 inches.

The Bakeoven soil has moderately slow permeability. Effective rooting depth is 5 to 12 inches. Available water capacity is 0.5 to 1.5 inches. Water supplying capacity is less than 2.5 inches. Runoff is slow to medium, and the hazard of erosion is moderate.

The Valby soil has moderate permeability. Effective rooting depth is 20 to 40 inches. Available water capacity is 4 to 8.5 inches. Water supplying capacity is 6 to 8 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Nearly all the unit is used for livestock grazing and wildlife habitat.

The major concern in management is maintaining an adequate plant cover for control of water erosion.

On the Valby soil, the native plant community is dominated by bluebunch wheatgrass. Idaho fescue, Sandberg bluegrass, and a variety of perennial forbs are prominent. Shrubs are minor. On the Bakeoven soil, the plant community is dominated by Sandberg bluegrass and varying amounts of stiff sagebrush. It also includes a few low growing perennial forbs.

If range condition deteriorates, the productive bunchgrasses decrease and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe, the stand of bunchgrass on the Valby soil and the stand of stiff sagebrush on the Bakeoven soil are nearly eliminated. As a result, annual weeds and a few shrubs occupy the deeper Valby soil and a rock pavement forms on the interspersed Bakeoven soil.

Because of interspersed areas of the very shallow and stony Bakeoven soil, range seeding generally is not practical.

Most areas of this unit provide food and limited cover for mule deer, small mammals, game birds, and song birds.

Stoniness and depth to bedrock are limitations for community and recreation uses on the Bakeoven soil. Extensive design modifications are needed but in most places are not practical for dwellings, small buildings, and sanitary facilities.

Depth to bedrock is a limitation for community uses on the Valby soil. Design modifications are needed for dwellings, small buildings, and sanitary facilities.

The capability subclass is VIIs.

5E—Boardtree loam, 7 to 40 percent slopes. This is a very deep, well drained soil formed in volcanic ash over clay. It is generally on north-facing slopes at elevations of 3,500 to 4,600 feet. The average slope is 20 percent. The average annual precipitation is 18 to 25 inches. The average annual air temperature is 42 to 45 degrees F. The frost free period is 30 to 60 days at 32 degrees and 80 to 100 days at 28 degrees.

In a representative profile the surface layer is dark brown and brown loam about 14 inches thick. The subsoil is about 11 inches of brown loam over 15 inches of brown clay. Below this is brown clay loam that extends to 60 inches or more.

About 10 percent of this unit is included areas of Klicker stony silt loam, shallow very stony loam soils, and shallow very stony ashy soils; 10 percent is Hankins silt loam and Tolo silt loam; and 1 percent is basalt outcrop.

Permeability is moderately rapid in the ashy material and very slow below. Effective rooting depth is restricted by the clay layer at a depth of 20 to 40 inches. Available water capacity is 8 to 12 inches. Water supplying capacity is 15 to 20 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for timber production, range, recreation, and wildlife habitat.

This soil is suited to the production of Douglas-fir. At a site index of 70 (*5*), it is capable of producing about 3,760 cubic feet of merchantable timber from a fully stocked stand at 40 years or 43,160 board feet (Scribner) of merchantable timber from a fully stocked stand at 130 years.

Slopes less than 30 percent are generally suitable for tractor logging. Cable logging is desirable on slopes of more than 30 percent. Excessive soil disturbance should be avoided because removing the overlying ash layer and exposing the infertile buried horizons adversely affect natural regeneration. If enough of this material is removed the productivity of the area affected may be lowered permanently. Excessive soil disturbance may also result in severe erosion and water quality deterioration. The 20- to 40-inch ash layer makes the construction and maintenance of roads difficult. This material provides poor subgrade for roads. It does not compact easily, and it has frost action potential and a high water holding capacity. The amount of ballast depends upon the number and type of vehicles using the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is ponderosa pine and Douglas-fir, but it is predominantly pine. In a moderately stocked mixed-age stand the canopy cover is 20 to 40 percent. Douglas-fir occurs in varying amounts and may dominate the tree regeneration in places. The understory is dominated by pinegrass and elk sedge. A variety of perennial forbs and a few shrubs occur throughout the stand.

If the understory deteriorates, the proportion of pinegrass and elk sedge decreases, principally elk sedge. If deterioration is severe, shrubs and tree reproduction proportionately increase and forbs become prominent.

Following fire or logging, broadcast seeding is advisable before fall rains settle the seedbed. A major objective of seeding is to stabilize disturbed soil areas. Plants suitable for seeding are intermediate wheatgrass, orchardgrass, timothy, and hard fescue.

Mule deer use the plant community for food and cover in summer and fall. Rocky Mountain elk use the plant community as winter range and as cover during winter storms. A variety of small mammals and birds, including game birds such as blue and ruffed grouse, also use this community.

Very few dwellings have been constructed on this soil. Most are used seasonally for recreation purposes. The slope, slow permeability, high shrink-swell potential, and low strength of the soil material limit all uses for community and recreation development and recreation facilities.

The capability subclass is VIe.

6C—Bocker extremely cobbly silt loam, 2 to 12 percent slopes. This is a very shallow, well drained soil formed in loess and in residuum from basalt. It is on ridgetops at elevations of 3,700 to 5,500 feet. The average slope is 5 percent. The average annual precipitation is 24 to 30 inches, and the average annual air temperature is 42 to 45 degrees F. The frost free period is 40 to 85 days at 32 degrees and 80 to 120 days at 28 degrees.

In a representative profile the surface layer is dark reddish brown extremely cobbly silt loam about 8 inches thick. Basalt is at a depth of about 8 inches.

About 5 percent of this unit is included areas of Hall Ranch, Klicker, and Wrightman soils, 5 percent is Helter and Tolo soils, and 5 percent is Gwin soils.

Permeability is moderate. Effective rooting depth is 4 to 10 inches. Available water capacity is 0.5 to 1.5 inches. Water supplying capacity is 1 to 4 inches. Runoff is slow to medium, and the hazard of erosion is moderate.

Nearly all the acreage is used for livestock grazing and wildlife habitat.

The major concern is maintaining an adequate plant cover for control of water erosion.

The native plant community is dominated by very shallow rooted plants, such as Sandberg bluegrass and Oregon bluegrass. In places Idaho fescue and bluebunch wheatgrass occur in small amounts. Low growing perennial forbs, such as pussytoes and phlox, are common.

If range condition deteriorates, small bluegrasses decrease and the proportion of low value forbs increases. If deterioration is severe, most plants are nearly eliminated and a barren rock pavement forms.

Because the soil is very shallow and stony, renovation by seedbed preparation and seeding is not practical.

Areas of this soil provide limited food and cover for mule deer, Rocky Mountain elk, small mammals, game birds, and song birds. The plant community provides green succulent feed for mule deer in winter and early spring when other areas are snow covered.

Stoniness and depth to bedrock are limitations for community and recreation uses. Extensive design modifications are needed but in most places are not practical for dwellings, small buildings, and sanitary facilities.

The capability subclass is VIIs.

7C—Bocker-Wrightman complex, 2 to 12 percent slopes. This map unit is on ridgetops in the Blue Mountains at elevations of 3,700 to 5,500 feet. It is 50 percent the very shallow Bocker soil, which formed in loess and in residuum from basalt; 35 percent the moderately deep Wrightman soil, which formed in material weathered from basaltic rock and reworked loess; 10 percent Hall Ranch, Klicker, and Gwin soils; and 5 percent Tolo and Helter soils. Both Bocker and Wrightman soils formed over basalt. Both are well drained. This unit occurs as patterned land, known locally as biscuit scabland. The Bocker soil occurs as scabland between and around areas of the Wrightman soil. Wrightman soils occur as circular mounds, or biscuits, that have a convex surface and are deepest at the center. The circular mounds are 20 to 50 feet in diameter and 20 to 40 feet apart.

The average slope is 10 percent. The average annual precipitation is 22 to 26 inches, and the average annual air temperature is 42 to 45 degrees F. The frost free period is 40 to 85 days at 32 degrees and 80 to 120 days at 28 degrees.

In a representative profile of Bocker extremely cobbly silt loam the surface layer is dark reddish brown and is about 8 inches thick. Basalt is at a depth of about 8 inches.

In a representative profile of Wrightman silt loam the surface layer is dark brown and is about 12 inches thick. The upper 9 inches of the subsoil is dark brown silt loam, and the lower 5 inches is dark brown gravelly silt loam. Fractured basalt is at a depth of about 26 inches.

The Bocker soil has moderate permeability. Effective rooting depth is 4 to 10 inches. Available water capacity is 0.5 to 1.5 inches. Water supplying capacity is 1 to 4 inches. Runoff is slow to medium, and the hazard of erosion is moderate.

The Wrightman soil has moderate permeability. Effective rooting depth is 20 to 40 inches. Available water capacity is 3 to 7 inches. Water supplying capacity is 13 to 16 inches. Runoff is medium, and the hazard of erosion is moderate.

Nearly all this unit is used for livestock grazing and wildlife habitat.

The major concern in management is maintaining an adequate plant cover for control of water erosion.

On the Bocker soil, the native plant community is dominated by very shallow rooted plants, such as Sandberg bluegrass or Oregon bluegrass. Idaho fescue and bluebunch wheatgrass occur in small amounts. Low growing perennial forbs, such as pussytoes and phlox, are common. On the Wrightman soil, the plant community is dominated by Idaho fescue. Bluebunch wheatgrass and Sandberg bluegrass are prominent. Various perennial forbs, such as arrowleaf balsamroot, milkvetch, and yarrow, occur throughout the stand in small amounts. There are few or no shrubs.

If range condition deteriorates, plant vigor is greatly reduced. The proportion of bluebunch wheatgrass and other desirable grasses decreases on the Wrightman soil. The stand of small bluegrasses decreases and the proportion of low value forbs increases on the Bocker soil. If deterioration is severe on the Wrightman soil, cheatgrass and other low value plants are predominant and the erosion potential is high. If deterioration is severe on the Bocker soil, plants are nearly eliminated and a barren rock pavement forms.

Because of interspersed areas of the very shallow and stony Bocker soil, range seeding generally is not practical.

Most areas of this unit provide food and limited cover for mule deer, small mammals, game birds, and song birds.

Slope, depth to bedrock, and the small size of the biscuits, or circular mounds, are limitations for community developments and recreation facilities. Variations in design, which are not very practical, must be carefully implemented.

The capability subclass is VIIs.

8B—Burbank loamy fine sand, 2 to 5 percent slopes. This is a very deep, excessively drained soil formed in gravelly alluvial deposits and wind worked material. It occurs on terraces at elevations of 300 to 800 feet. The average slope is 3 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 160 to 200 days at 32 degrees and 180 to 215 days at 28 degrees F.

In a representative profile the surface layer is very dark grayish-brown loamy fine sand about 5 inches thick. The substratum is about 15 inches of dark brown, loamy fine sand over 14 inches of dark brown, very cobbly loamy fine sand. Below this is very cobbly sand and gravel that extends to a depth of 60 inches or more.

About 15 percent of this unit is included areas of Hezel loamy fine sand, Quincy loamy fine sand, and Winchester sand.

Permeability is rapid. Effective rooting depth is restricted by the underlying gravel at a depth of 20 to 40 inches. Available water capacity is 1.5 to 3.5 inches. Water supplying capacity is 5 to 6.5 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. A large part of the acreage is used for range and wildlife habitat, particularly where the soil occurs within the Boardman Naval Reservation. Major irrigated crops include potatoes, annual wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the low water holding capacity and the hazard of soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the low water holding capacity and high water consumption, light to medium, frequent applications of irrigation water are needed. Plant nutrients are readily leached from the rooting zone because of the very rapid permeability. Split applications of fertilizer are desirable.

Deep cuts should be avoided because they expose the cobbly substratum, which adversely affects plant growth.

The hazard of soil blowing is high because of the loamy fine sand surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and hummocks in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Practices needed to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Blowout areas require special treatment, such as disked-in straw mulching and seeding to suitable grasses. Doublecropping and stripcropping are needed in places. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation systems before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on nonirrigated odd areas are the practices and precautions needed.

The native plant community is dominated by needleandthread and Indian ricegrass. Antelope bitterbrush commonly occurs and is prominent in places. Perennial forbs, such as Columbia milkvetch and Carey balsamroot, are common. Other shrubs, such as big sagebrush and rabbitbrush, occur sporadically.

If range condition deteriorates, the proportion of Indian ricegrass decreases and the proportion of needleandthread and low value forbs increases. If deterioration is severe, cheatgrass invades and strongly dominates the stand. As a result, the potential for soil blowing during the growing season is high and sand movement may be difficult to control.

If the range is in poor condition, total protection of the existing plant cover is practical. Standard methods of seedbed preparation and seeding present special problems because of the critical soil blowing hazard. Direct drill seeding of crested wheatgrass or Siberian wheatgrass is advisable after a fire.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil is generally well suited to community and recreation uses. Sewage lagoons and sanitary landfills may require variations in design because of seepage. Playgrounds may require levelling.

The capability subclass is VIIe dryland, IVe irrigated.

8C—Burbank loamy fine sand, 5 to 12 percent slopes. This is a very deep, excessively drained soil formed in gravelly alluvial deposits and wind worked material. It occurs on terraces at elevations of 300 to 800 feet. The average slope is 8 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 160 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown loamy fine sand about 5 inches thick. The substratum is about 15 inches of dark brown loamy fine sand over 14 inches of dark brown very cobbly loamy fine sand. Below this is gravel that extends to a depth of 60 inches or more.

About 15 percent of this unit is included areas of Hezel loamy fine sand, Quincy loamy fine sand, and Winchester sand.

Permeability is rapid. Effective rooting depth is restricted by the underlying gravel at a depth of 20 to 40 inches. Available water capacity is 1.5 to 3.5 inches. Water supplying capacity is 5 to 6.5 inches. Runoff is slow, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is high.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. A large part of the acreage is used for range and wildlife habitat, particularly where the soil occurs within the Boardman Naval Reservation. Major irrigated crops include potatoes, annual wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the low water holding capacity and the hazard of soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the low water holding capacity and high water consumption, light to medium, frequent applications of irrigation water are needed. Plant nutrients are readily leached from the root zone because of the very rapid permeability. Split applications of fertilizer are desirable.

Deep cuts should be avoided because they expose the cobbly substratum, which adversely affects plant growth.

The hazard of soil blowing is high because of the loamy fine sand surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and hummocks in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures needed to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Blowout areas require special treatment, such as disked-in straw mulching and seeding to suitable grasses. Doublecropping and stripcropping are needed in places. Protection from soil blowing is critical when rangeland is converted to cropland. Completely developing the irrigation systems before any land is broken out, limiting new disturbance to the period of March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is dominated by needleandthread and Indian ricegrass. Antelope bitterbrush is common and is prominent in places. Perennial forbs, such as Columbia milkvetch and Carey balsamroot, are common. Other shrubs, such as the big sagebrush and rabbitbrush, occur sporadically.

If range condition deteriorates, the proportion of Indian ricegrass decreases and the proportion of needleandthread and low value forbs increases. If deterioration is severe, cheatgrass invades and strongly dominates the stand. As a result, the potential for soil blowing during the growing season is severe and sand movement may be difficult to control.

If the range is in poor condition, total protection of the existing plant cover is practical. Standard methods of seedbed preparation and seeding present special problems because of the critical soil blowing hazard. Direct drill seeding to crested wheatgrass or Siberian wheatgrass is advisable after a fire.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil generally is well suited to community uses. The slope is a limitation for dwellings, recreation facilities, commercial buildings, and roads and streets. Modifications in the design of sanitary facilities may be required because of the seepage and the slopes.

The capability subclass is VIIe dryland, IVe irrigated.

9—Dune land. This map unit is excessively drained sandy eolian material. It is grayish brown or brown loamy sand, sand, or fine sand 60 inches or more thick. The slope is 5 to 60 percent. Elevation is 300 to 900 feet. Average annual precipitation is 7 to 9 inches, and average annual air temperature is 49 to 54 degrees F. The average frost-free period is 150 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

About 15 percent of this unit is Burbank, Hezel, Koehler, Quincy, Quinton, Royal, Sagehill, Taunton, and Winchester soils.

Permeability is rapid to very rapid. Available water capacity is 2 to 5 inches. Water supplying capacity is 2 to 3 inches. Effective rooting depth is about 60 inches. Runoff is slow. The hazard of water erosion is slight. The hazard of soil blowing is high.

The slope, rapid permeability, and soil blowing are limitations for community and recreation developments. Dune land is nearly devoid of vegetation. It is not suitable for grazing. It can be stabilized by planting improved perennial grasses or nursery grown plants or clones of Volga wild rye 20 inches apart in rows spaced 20 inches apart. It is used mainly as wildlife habitat.

The capability subclass is VIIIe.

10B—Ellum fine sandy loam, 2 to 5 percent slopes. This is a moderately deep, well drained soil formed in water deposited sand and gravel. It is on terraces at elevations of 300 to 800 feet. The average slope is 3 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 140 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark brown fine sandy loam about 5 inches thick. The substratum is 8 inches of dark brown fine sandy loam over 15 inches of dark brown very gravelly and extremely fine sandy loam. A calcareous very gravelly hardpan is at a depth of 28 inches.

About 20 percent of this unit is included areas of Irrigon and Taunton soils and 10 percent is Burbank and Sagehill soils.

Permeability is moderately rapid. Effective rooting depth is restricted by the hardpan at a depth of 20 to 40 inches. Available water capacity is 2 to 4.5 inches. Water supplying capacity is 5 to 6.5 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used as range and wildlife habitat.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrass decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses should be considered. Because of the hazard of soil blowing, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

Seepage and a cemented pan are limitations for sanitary facilities. Construction of dwellings may require some design modification because of the pan. Playgrounds may require leveling.

The capability subclass is VIe dryland.

10C—Ellum fine sandy loam, 5 to 12 percent slopes. This is a moderately deep, well drained soil formed in water deposited sand and gravel. It is on terraces at elevations of 300 to 800 feet. The average slope is 8 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 140 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark brown fine sandy loam about 5 inches thick. The substratum is 23 inches thick. It is dark brown fine sandy loam over very gravelly and extremely gravelly fine sandy loam. A calcareous very gravelly hardpan is at a depth of 28 inches.

About 20 percent of this unit is included areas of Irrigon and Taunton soils and 10 percent is Burbank and Sagehill soils.

Permeability is moderately rapid. Effective rooting depth is restricted by the hardpan at a depth of 20 to 40 inches. Available water capacity is 2 to 4.5 inches. Water supplying capacity is 5 to 6.5 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used as range and wildlife habitat.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrass decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses should be considered. Because of the moderate hazard of soil blowing, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The seepage and cemented pan are limitations for sanitary facilities. Construction of dwellings and buildings may require some design modifications because of the pan and slope. Playgrounds may require leveling.

The capability subclass is VIe dryland.

11—Endersby fine sandy loam. This is a very deep, somewhat excessively drained soil formed in alluvium derived from loess and volcanic ash. It is on alluvial bottom lands at elevations of 1,200 to 2,500 feet. The average slope is 1 percent. The average annual precipitation is 11 to 14 inches, and the average annual air temperature is 49 to 51 degrees F. The frost free period is 130 to 170 days at 32 degrees and 170 to 210 days at 28 degrees.

In a representative profile the surface layer is dark brown fine sandy loam about 12 inches thick. The substratum is dark brown and very dark grayish brown fine sandy loam about 24 inches thick. Below this is black heavy silt loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Onyx and Pedigo soils and 5 percent is Esquatzel, Kimberly, and Snow soils.

Permeability is moderately rapid. Effective rooting depth is more than 60 inches. Available water capacity is 7.5 to 12 inches. Water supplying capacity is 9 to 12 inches. Runoff is slow, and the hazard of erosion is slight. Flooding is rare.

Nearly all the acreage is used for dryfarmed and irrigated crops. Hay and pasture are the main crops. Some winter wheat is also grown. Some irregularly shaped areas are used as range.

The major needs in crop management are conserving soil moisture and stabilizing streambanks against cutting by water. The proper timing and rates of applying irrigation water should be considered. Where water is available, irrigation is by sprinklers, most commonly wheelline or handline systems.

A suitable cropping system under irrigation is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Because of the moderately rapid permeability and high water consumption, light, frequent applications of irrigation water are needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the root zone by the irrigation water.

Stubble mulch and minimum tillage along with a crop-fallow system where wheat is grown help to conserve soil moisture in dryfarmed cropland.

Streambanks can be stabilized by maintaining streamside vegetation, especially giant wildrye and riparian shrubs. Such vegetation also serves as important wildlife cover and should be considered in planning management.

For dryland pasture and hay, suitable grasses grown alone or in various combinations are alfalfa, Siberian wheatgrass, crested wheatgrass, beardless wheatgrass, big bluegrass, intermediate wheatgrass, pubescent wheatgrass, and hard fescue (*3*).

Areas of this soil provide good food and cover for upland game birds, such as the ring-necked pheasant and valley quail, and for mule deer and smaller mammals.

This soil occurs on stream flood plains and is subject to rare flooding, which results in limitations for many community developments.

The capability subclass is IIIs dryland and irrigated.

12—Esquatzel silt loam. This is a very deep, well drained soil formed in alluvium derived from loess and volcanic ash. It is on alluvial bottom lands at elevations of 600 to 2,000 feet. The average slope is 1 percent. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 51 to 53 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 200 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown silt loam about 17 inches thick. The subsoil is dark brown silt loam about 8 inches thick. The substratum is dark brown silt loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Kimberly soils and Xeric Torriorthents and is 5 percent Endersby and Onyx soils.

Permeability is moderate. Effective rooting depth is 60 inches or more. Available water capacity is 7.5 to 12 inches. Water supplying capacity is 5 to 9 inches. Runoff is slow, and the hazard of erosion is slight. Flooding is rare.

All the acreage is used for dryfarmed and irrigated crops. Hay and pasture are the main crops. Some winter wheat is also raised.

The major needs in crop management are conserving soil moisture and stabilizing streambanks against cutting by water. The proper timing and rates of applying irrigation water should be considered. Where water is available, irrigation is by sprinklers, most commonly wheelline or handline systems.

A suitable cropping system under irrigation is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Because of the high water consumption, light, frequent applications of irrigation water is needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the root zone by the irrigation water.

Stubble mulch and minimum tillage along with a crop-fallow system where wheat is grown help to minimize erosion and help to conserve soil moisture in dryfarmed cropland.

Streambanks can be stabilized by maintaining streamside vegetation, especially giant wildrye and such riparian shrubs as lilac and willow. Such vegetation also serves as important wildlife cover and should be considered in planning management.

For dryland pasture and hay, suitable grasses grown alone or in various combinations are alfalfa, crested wheatgrass, Siberian wheatgrass, beardless wheatgrass, intermediate wheatgrass, and big bluegrass (*3*).

This soil provides important food and cover for upland game birds, such as the ring-necked pheasant and valley quail, and for mule deer and smaller mammals.

This soil occurs on stream flood plains and is subject to rare flooding, which results in limitations for many community developments.

The capability subclass is IIIc dryland, I irrigated.

13D—Gravden very gravelly loam, 5 to 20 percent slopes. This is a shallow, well drained soil formed in loess mixed with gravelly alluvium and colluvium. It is on south- and west-facing slopes at elevations of 500 to 1,700 feet. The average slope is 10 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 50 to 54 degrees F. The frost free period is 150 to 190 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark brown very gravelly loam about 7 inches thick. The substratum is brown extremely gravelly loam about 7 inches thick. A very gravelly hardpan is at a depth of about 14 inches.

Included with this soil in mapping are areas of Ritzville and Warden soils.

Permeability is moderate. Effective rooting depth is restricted by the very gravelly hardpan at a depth of 10 to 20 inches. Available water capacity is 1 to 4 inches. Water supplying capacity is 3 to 4 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for range and wildlife habitat.

The native plant community is dominated by bluebunch wheatgrass and Sandberg bluegrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor in the stand.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is left bare.

If the range is in poor condition, seedbed preparation and seeding should be considered. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

This soil supports small populations of mule deer. Birds and small mammals are common.

The cemented pan is a severe limitation for septic tanks and sewage lagoons. Construction of dwellings and buildings may require variations in design because of the rare flooding and the pan. Recreation facilities are limited because of small stones.

The capability subclass is VIe dryland.

13E—Gravden very gravelly loam, 20 to 40 percent slopes. This is a shallow, well drained soil formed in loess mixed with alluvium and colluvium. It is on south- and west-facing slopes at elevations of 500 to 1,700 feet. The average slope is 25 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 50 to 54 degrees F. The frost free period is 150 to 190 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark brown very gravelly loam about 7 inches thick. The substratum is brown extremely gravelly loam about 7 inches thick. A very gravelly hardpan is at a depth of about 14 inches.

Included with this soil in mapping are areas of Ritzville and Warden soils.

Permeability is moderate. Effective rooting depth is restricted by the very gravelly hardpan at a depth of 10 to 20 inches. Available water capacity is 1 to 4 inches. Water supplying capacity is 3 to 4 inches. Runoff is rapid, and the hazard of erosion is high.

This soil is used for range and wildlife habitat.

The native plant community is dominated by bluebunch wheatgrass. Sandberg bluegrass and Thurber needlegrass are prominent. A variety of perennial forbs occurs throughout the stand in small amounts. Shrubs are minor in the stand.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and Thurber needlegrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, much of the surface is bare and the potential for erosion is high.

Because this soil is shallow and stony, range seeding generally is not practical.

This soil supports small populations of mule deer. Birds and small mammals are common.

The slope and cemented pan are severe limitations for community development. The slope and small stones are severe limitations for recreation facilities.

The capability subclass is VIe dryland.

14E—Gwin extremely stony silt loam, 12 to 40 percent slopes. This is a shallow, well drained soil formed in loess, volcanic ash, and colluvium from basalt. It is on south-facing slopes (fig. 5) in the Blue Mountains at elevations of 2,600 to 4,400 feet. The average slope is 25 percent. The average annual precipitation is 16 to 25 inches, and the average annual air temperature is 45 to 49 degrees F. The average frost free period is 80 to 110 days at 32 degrees and 110 to 140 days at 28 degrees.

In a representative profile the surface layer is very dark brown extremely stony silt loam about 3 inches thick. The subsoil is very dark brown and dark brown very cobbly and extremely cobbly silt loam and clay loam about 12 inches thick. Basalt is at a depth of about 15 inches.

About 15 percent of this unit is included areas of Bocker and Waterbury soils and 10 percent is Klicker, Hall Ranch, and Tolo soils.

Permeability is moderately slow. Effective rooting depth is 10 to 20 inches. Available water capacity is 1.5 to 2.5 inches. Water supplying capacity is 7 to 14 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for livestock grazing and wildlife habitat. The major concern is maintaining an adequate plant cover for control of water erosion.

The native vegetation is a plant community dominated by bluebunch wheatgrass. Idaho fescue and Sandberg bluegrass are prominent. Various perennial forbs, such as arrowleaf balsamroot, milkvetch, and yarrow, occur throughout the stand in small amounts. There are few or no shrubs.

If range condition deteriorates, plant vigor is greatly reduced and the proportion of bluebunch wheatgrass and other desirable grasses decreases. If deterioration is severe, cheatgrass and other low value plants predominate and the potential for erosion is high.

Because this soil is stony and shallow, range seeding is not practical.

The plant community is used by Rocky Mountain elk and mule deer in winter and early in spring when other areas are snow covered.

The depth to bedrock, stoniness, and steep slopes are severe limitations for community and recreation uses. Extensive design modifications are needed but in most cases are not practical for dwellings, small buildings, and sanitary facilities.

The capability subclass is VIIs.

15F—Gwin-Rock outcrop complex, 40 to 70 percent slopes. This map unit is on south-facing slopes in the Blue Mountains at elevations of 2,600 to 4,400 feet. It is 55 percent Gwin soil, 25 percent Rock outcrop, 10 percent Bocker soil and Rubble land, and 10 percent Klicker and Hall Ranch soils.

The average slope is about 50 percent. The average annual precipitation is 16 to 25 inches, and the average annual air temperature is 45 to 49 degrees F. The frost free period is 80 to 110 days at 32 degrees and 110 to 140 days at 28 degrees.

In a representative profile of Gwin extremely stony silt loam the surface layer is very dark brown and is about 3 inches thick. The subsoil is very dark brown and dark brown very cobbly and extremely cobbly silt loam and clay loam about 12 inches thick. Basalt is at a depth of about 15 inches.

Rock outcrop is basalt bedrock.

The Gwin soil has moderately slow permeability. Effective rooting depth is 10 to 20 inches. Available

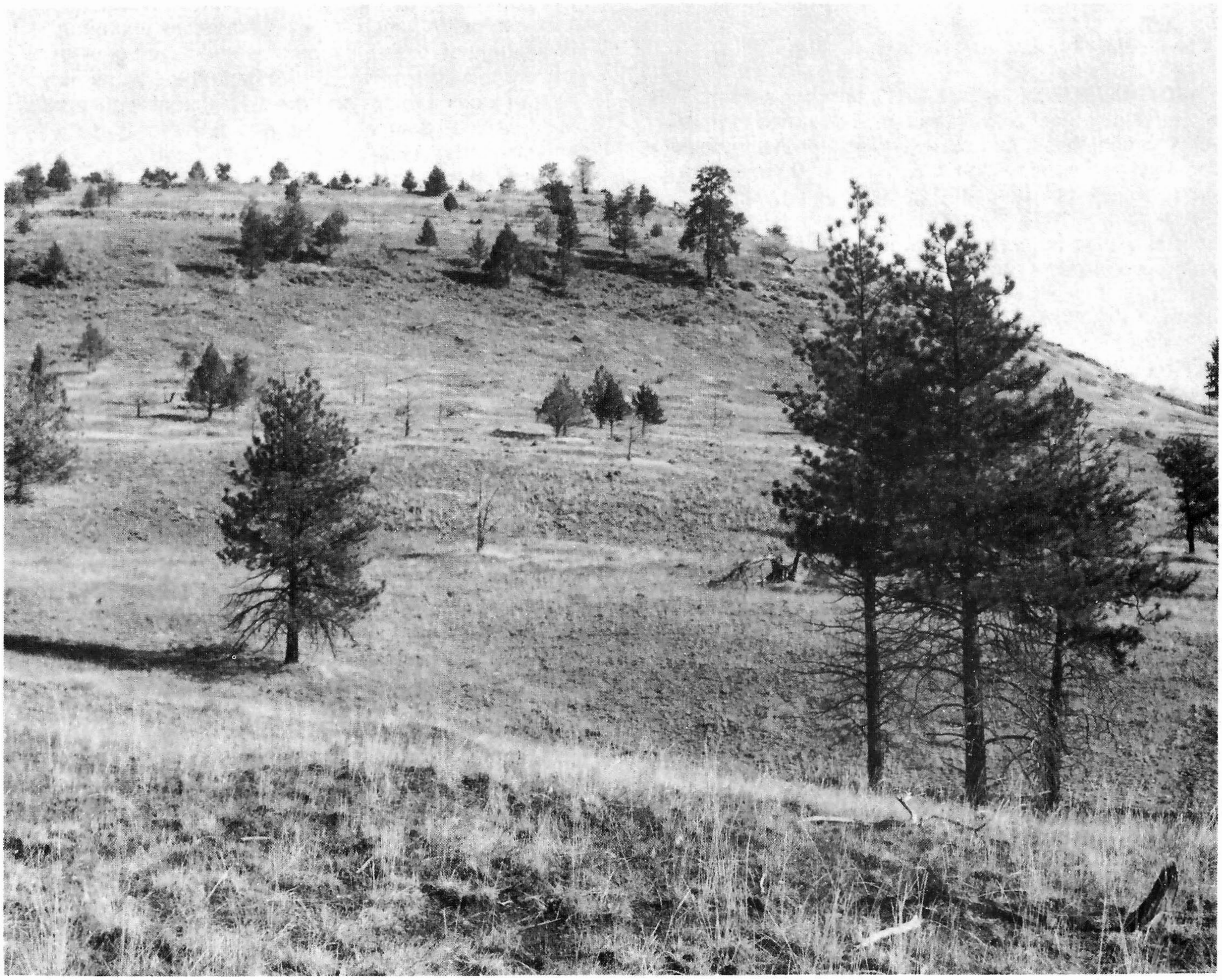


Figure 5.—Gwin extremely stony silt loam, 12 to 40 percent slopes, in background In the foreground is an area of Bocker-Wrightman complex, 2 to 12 percent slopes.

water capacity is 1.5 to 2.5 inches. Water supplying capacity is 7 to 14 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for livestock grazing and wildlife habitat.

The native vegetation is a plant community dominated by bluebunch wheatgrass. Sandberg bluegrass and Thurber needlegrass are prominent. A variety of perennial forbs and a few shrubs are included.

If range condition deteriorates, plant vigor is greatly reduced and the proportion of bluebunch wheatgrass and other desirable grasses decreases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, low value plants predominate, the soils are subject to erosion, and much of the surface is bare and rocky.

Because this unit is very stony and slopes are steep, range seeding is not practical. At the higher elevations, the plant community is used by Rocky Mountain elk and mule deer in winter and early in spring when other areas are snow covered.

Shallowness over bedrock, stones, rock outcrop, and very steep slopes are severe limitations for community and recreation uses. Extreme design modifications are needed but are rarely practical for dwellings, small buildings, and sanitary facilities.

The capability subclass is VIIs.

16C—Hall Ranch loam, 2 to 12 percent slopes. This is a moderately deep, well drained soil formed in mixed volcanic ash, loess, and colluvium from granite, andesite, and rhyolite. The elevation is 3,500 to 4,800 feet. The average slope is 7 percent. The average annual precipitation is 18 to 28 inches, and the average annual air temperature is 43 to 45 degrees F. The frost-free period is 50 to 80 days at 32 degrees and 80 to 110 days at 28 degrees.

In a representative profile the surface layer is dark reddish brown loam about 7 inches thick. The subsoil is dark reddish brown loam about 16 inches thick. Soft andesite is at a depth of about 23 inches.

About 20 percent of this unit is included areas of Klicker soils and 10 percent is Boardtree, Hankins, and Tolo soils.

Permeability is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is 3 to 7 inches. Water supplying capacity is 8 to 16 inches. Runoff is slight, and the hazard of erosion is slight.

This soil is used for timber production, range, and wildlife habitat.

This soil is suited to the production of ponderosa pine. At a site index of 79 (*8*), it is capable of producing about 3,350 cubic feet of merchantable timber from a fully stocked stand at 50 years or 35,040 board feet (Scribner) of merchantable timber from a fully stocked stand at 160 years.

Tractor logging is suitable on this soil. The soil provides only poor to fair subgrade for roads. The amount of ballast depends upon the number and type of vehicles using the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is ponderosa pine and Douglas-fir, but predominantly pine. In a moderately stocked, mixed-age stand, the canopy cover is 20 to 40 percent. Douglas-fir occurs in varying amounts and may dominate the tree regeneration in places. The understory is dominated by pinegrass and elk sedge. A variety of perennial forbs and a few shrubs occur throughout the stand.

If the understory deteriorates, the proportion of pinegrass and elk sedge decreases, principally elk sedge. If deterioration is severe, shrubs and tree production proportionately increase and forbs become prominent.

Following fire or logging, broadcast seeding is advisable before fall rains settle the seedbed. A major objective of seeding is to stabilize disturbed soil areas. Plants suitable for seeding are intermediate wheatgrass, orchardgrass, timothy, and hard fescue.

Mule deer use the plant community for food and cover in summer and autumn. Rocky Mountain elk use the plant community as winter range and as cover during winter storms. A variety of small mammals and birds, including game birds such as blue and ruffed grouse, also use this community. Openings in the canopy as a result of logging or fire and the subsequent regeneration provide a good source of food and cover for these various kinds of wildlife.

The depth to bedrock and, in some places, the slope are limitations in community development. Variations in design need to be carefully implemented for successful utilization of this soil. The slope is a limitation for campgrounds, picnic areas, and playgrounds.

The capability subclass is VIc.

17E—Hall Ranch gravelly loam, 12 to 35 percent slopes. This is a moderately deep, well drained soil formed in mixed volcanic ash, loess, and colluvium from granite, andesite, and rhyolite. The elevation is 3,500 to 4,800 feet. The average slope is 20 percent. The average annual precipitation is 18 to 28 inches, and the average annual air temperature is 43 to 45 degrees F. The frost free period is 50 to 80 days at 32 degrees and 80 to 110 days at 28 degrees.

In a representative profile, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown loam about 16 inches thick. Soft andesite is at a depth of about 23 inches.

About 20 percent of this unit is included areas of Klicker soils and 10 percent is Boardtree, Hankins, and Tolo soils.

Permeability is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is 3 to 7 inches. Water supplying capacity is 8 to 16 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for timber production, range, and wildlife habitat.

This soil is suited to the production of ponderosa pine. At a site index of 79 (*8*), it is capable of producing about 3,350 cubic feet of merchantable timber from a fully stocked stand at 50 years or 35,040 board feet (Scribner) of merchantable timber from a fully stocked stand at 160 years.

Tractor logging is suitable in most areas of this soil. Cable logging may be desirable on some of the steeper slopes. The soil provides only poor to fair subgrade for roads. The amount of ballast depends on the number and type of vehicles using the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is ponderosa pine and Douglas-fir, but predominantly pine. In a moderately stocked, mixed-age stand, the canopy cover is 20 to 40 percent. Douglas-fir occurs in varying amounts and may dominate tree regeneration in places. The understory is dominated by pinegrass and elk sedge. A variety of perennial forbs and a few shrubs occur throughout the stand.

If the understory deteriorates, the proportion of pinegrass and elk sedge decreases, principally elk sedge. If deterioration is severe, shrubs and tree reproduction proportionately increase and forbs become prominent.

Following fire or logging, broadcast seeding is advisable before fall rains settle the seedbed. A major objective of seeding is to stabilize disturbed soil areas. Plants suitable for seeding are intermediate wheatgrass, orchardgrass, timothy, and hard fescue.

Mule deer use the plant community for food and cover in summer and autumn. Rocky Mountain elk use the community as winter range and as cover during winter storms. A variety of small mammals and birds, including game birds such as blue and ruffed grouse, also use this community. Openings in the canopy as a result of logging or fire and the subsequent regeneration provide a good source of food and cover for these various kinds of wildlife.

The depth to bedrock and the slope are limitations for community development and recreation facilities. Variations in design should be carefully implemented for successful utilization of this soil.

The capability subclass is VIe.

18E—Hankins silt loam, 5 to 35 percent south slopes. This is a very deep, well drained soil formed in colluvium mixed with ash and fine textured sediment. It is on south-facing slopes in the Blue Mountains at elevations of 3,500 to 5,000 feet. The average slope is 20 percent. The average annual precipitation is 18 to 25 inches, and the average annual air temperature is 43 to 45 degrees F. The frost free period is 60 to 90 days at 32 degrees and 90 to 110 days at 28 degrees.

In a representative profile the surface layer is very dark gray and very dark grayish brown silt loam and heavy silt loam about 12 inches thick. The subsoil is dark brown and yellowish brown clay about 35 inches thick. The substratum is yellowish brown and light yellowish brown clay loam that extends to a depth of 60 inches or more.

About 15 percent of this unit is included areas of Boardtree, Klicker, and Tolo soils.

Permeability is slow. Effective rooting depth is 40 to 60 inches. Available water capacity is 6 to 9 inches. Water supplying capacity is 13 to 16 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used for timber production, range, recreation, and wildlife habitat.

This soil is suited to the production of ponderosa pine. At a site index of 71 (*8*), it is capable of producing about 2,800 cubic feet of merchantable timber from a fully stocked stand at 50 years or 28,300 board feet (Scribner) of merchantable timber from a fully stocked stand at 160 years.

Tractor logging is suitable in most areas of this soil. Cable logging may be desirable where slopes are more than 30 percent. When wet, this soil is sticky and plastic. Tractor logging in spring when the soil is likely to be saturated may compact the soil severely, reducing natural regeneration and increasing runoff. The soil material provides only poor to fair subgrade for roads. The amount of ballast depends upon the number and type of vehicles using the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is ponderosa pine. In a moderately stocked, mixed-age stand, the tree canopy cover generally is less than 30 percent. Douglas-fir occurs in minor amounts but it may increase as the elevation increases. The understory is dominated by elk sedge. Pinegrass is prominent. A variety of perennial forbs and a few shrubs occur throughout the stand.

As the understory deteriorates, elk sedge decreases and the proportion of forbs and shrubs increases. If deterioration is severe, elk sedge is nearly eliminated and the stand becomes weedy. "Dog-hair" thickets of pine may occur as the understory deteriorates.

Following fire or logging, broadcast seeding is advisable before fall rains. A major objective of seeding is to stabilize disturbed soil areas. Plants suitable for seeding are intermediate wheatgrass, smooth brome, hard fescue, and white clover.

This plant community is used in summer and fall by mule deer and is part of the winter range for Rocky Mountain elk. A variety of small mammals and birds, including game birds such as blue and ruffed grouse, also use this community.

The slope, the high content of clay, and the slow permeability are limitations for community developments and recreation facilities. Modifications in design should be carefully implemented for successful utilization of this soil.

The capability subclass is VIe.

19C—Helter silt loam, bedrock substratum, 3 to 15 percent slopes. This is a deep, well drained soil formed in volcanic ash and wind laid silt mixed with granite and basalt colluvium. It occurs in the Blue Mountains at elevations of 4,500 to 5,500 feet. The average slope is about 6 percent. The average annual air temperature is 40 to 44 degrees F. The frost free period is 20 to 50 days.

In a representative profile the surface layer is dark grayish brown loam about 3 inches thick. The subsoil is 52 inches thick. The upper 23 inches is yellowish brown and light yellowish brown silt loam, the next 11 inches is a buried subsoil of dark yellowish brown loam, and the lower 18 inches is a buried subsoil of yellowish brown very gravelly loam. Andesite is at a depth of about 55 inches.

About 10 percent of this unit is included areas of Hall Ranch and Klicker soils, 1 percent is Aquepts and Aquolls, and 1 percent is Bocker and Gwin soils.

Permeability is moderately slow. Available water capacity is 9 to 17 inches. Water supplying capacity is 12 to 16 inches. Effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This soil is used for timber production, range, recreation, and wildlife habitat.

This soil is suited to the production of Douglas-fir. At a site index of 78 (*8*), it is capable of producing about 3,250 cubic feet of timber from a fully stocked stand at 50 years or 34,240 board feet (Scribner) of merchantable timber from a fully stocked stand at 160 years.

Lodgepole pine also grows on this soil. At a site index of 80 (*9*), the soil is capable of producing 3,450 cubic feet of merchantable timber from a fully stocked, even-aged stand at 70 years or 19,700 board feet (Scribner) of merchantable timber from a fully stocked, even-aged stand at 100 years.

This soil is suited to tractor logging. Excessive soil disturbance, however, should be avoided because removing the overlying ash layer and exposing the less fertile buried horizons adversely affect natural regeneration. If enough of this ashy material is removed, the productivity of the affected area is lowered permanently. Excessive soil disturbance may also result in severe erosion and water quality deterioration. The 20- to 40-inch ash layer makes the construction and maintenance of roads difficult. This material provides poor subgrade for roads. It does not compact easily, and it has high potential frost action and a high water holding capacity. The amount of ballast depends upon the number and type of vehicles using the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is a mixed fir forest. The tree canopy is 40 to 70 percent. Western larch is subordinate in the stand. Under this canopy cover the foliar understory is dominated by plants that do not provide significant forage for domestic livestock. It is about 20 percent small red huckleberry and princes pine, 10 percent twinflower, 5 percent pachistima, and 5 percent lupine, false Solomons-seal, and heartleaf arnica. Lodgepole pine occurs in some areas that have been affected by fire. The trees in these stands range from 75 to 100 years. The canopy cover generally is more than that in the mixed fir forest. The understory of shade tolerant shrubs, forbs, and grasses decreases as the tree cover increases. This understory provides considerable forage as long as the canopy remains open.

Following fire or logging, broadcast seeding is advisable before fall rains. A major objective of seeding is to stabilize disturbed soil areas. Suitable for seeding are orchardgrass, timothy, hard fescue, and white clover.

Mule deer use this plant community for food and cover in summer and autumn. Rocky Mountain elk use it for winter range and for cover during daytime and winter storms.

Because this soil is in a remote location and the climate is severe, most anticipated developments are likely to be for recreation. The moderately slow permeability and depth to rock are severe limitations for septic tank absorption systems.

The capability subclass is VIe.

19E—Helter silt loam, bedrock substratum, 15 to 35 percent slopes. This is a deep, well drained soil formed in volcanic ash and wind laid silt mixed with granite and basalt colluvium. It occurs on north-facing slopes in the Blue Mountains at elevations of 4,500 to 5,500 feet. The average slope is about 20 percent. The average annual precipitation is 24 to 30 inches, and the average annual air temperature is 40 to 44 degrees F. The frost free period is 20 to 50 days.

In a representative profile the surface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is 52 inches thick. The upper 23 inches is yellowish brown and light yellowish brown silt loam, the next 11 inches is a buried subsoil of dark yellowish brown loam, and the lower 18 inches is a buried subsoil of yellowish brown very gravelly loam. Andesite is at a depth of about 55 inches.

About 10 percent of this unit is included areas of Hall Ranch and Klicker soils, 1 percent is Aquepts and Aquolls, and 1 percent is Bocker and Gwin soils.

Permeability is moderately slow. Available water capacity is 9 to 17 inches. Water supplying capacity is 12 to 16 inches. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is slight.

This soil is used for timber production, range, recreation, and wildlife habitat.

This soil is suited to the production of Douglas-fir (fig. 6). At a site index of 78 (*5*), it is capable of producing about 3,250 cubic feet of timber from a fully stocked stand at 50 years or 34,240 board feet (Scribner) of merchantable timber from a fully stocked stand at 160 years.

Lodgepole pine also grows on this soil. At a site index of 80 (*9*), the soil is capable of producing 3,450 cubic feet of merchantable timber from a fully stocked, even-aged stand at 70 years or 19,700 board feet (Scribner) of merchantable timber from a fully stocked, even-aged stand at 100 years.

The slope and the ash content are the main equipment limitations in harvesting timber. Most conventional cable logging systems can be used for harvest. The use of roads early in spring should be limited because the ash layer does not compact easily, has high potential frost action and a high water holding capacity, and is generally poor roadbed material.

The native vegetation is a mixed fir forest. The canopy cover is 40 to 70 percent. Western larch is subordinate in the stand. Under this canopy cover, the foliar understory is dominated by plants that do not provide

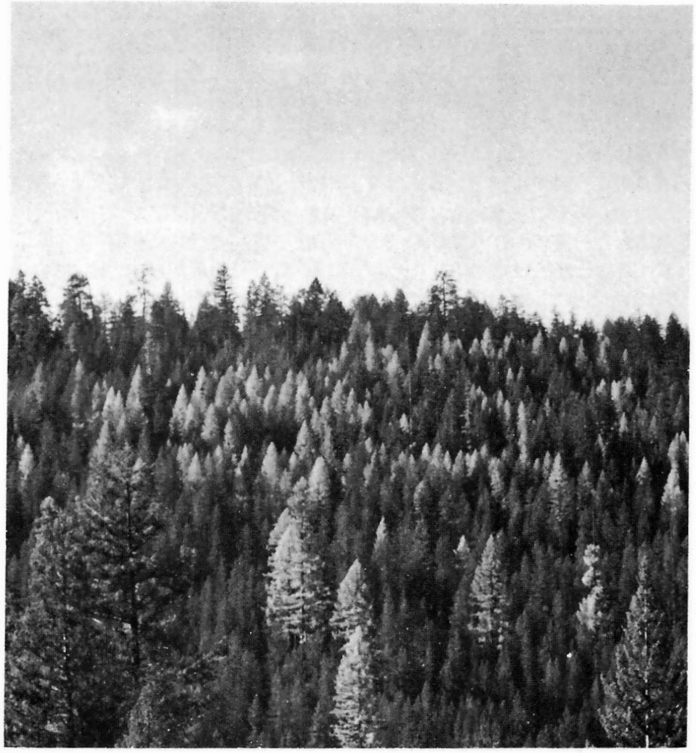


Figure 6.—Douglas-fir, western larch, and grand fir on Helter silt loam, bedrock substratum, 15 to 35 percent slopes.

significant forage for domestic livestock. It is about 20 percent small red huckleberry and princes pine, 10 percent twin flower, 5 percent pachistima, and 5 percent forbs, mainly lupine, false Solomons-seal, and heartleaf arnica. Lodgepole pine occurs in some areas that have been affected by fire. The trees in these stands range from 75 to 100 years. The canopy cover generally is more than that in the mixed fir forest. The understory of shade tolerant shrubs, forbs, and grasses decreases as the tree cover increases but provides considerable forage as long as the canopy remains open.

Following fire or logging, broadcast seeding is advisable before fall rains. A major objective of seeding is to stabilize disturbed soil areas. Suitable for seeding are orchardgrass, timothy, hard fescue, and white clover.

Mule deer use this plant community for food and cover in summer and autumn. Rocky Mountain elk use it for winter range and for cover during daytime and winter storms.

Because this soil is in a remote location and the climate is severe, most anticipated developments are likely to be for recreation. Some variation in design may be needed for dwellings and small buildings because of the slope. The moderately slow permeability and slope are severe limitations for septic tank absorption systems.

The capability subclass is VIe.

19F—Helter silt loam, bedrock substratum, 35 to 60 percent slopes. This is a deep, well drained soil formed in volcanic ash and wind laid silt mixed with granite and basalt colluvium. It occurs on north-facing slopes in the Blue Mountains at elevations of 4,500 to 5,500 feet. The average slope is about 50 percent. The average annual precipitation is 24 to 30 inches, and the average annual air temperature is 40 to 44 degrees F. The frost free period is 20 to 50 days.

In a representative profile the surface layer is dark grayish brown silt loam about 13 inches thick. The subsoil is 52 inches thick. The upper 23 inches is yellowish brown and light yellowish brown silt loam, the next 11 inches is a buried subsoil of dark yellowish brown loam, and the lower 18 inches is a buried subsoil of yellowish brown very gravelly loam. Andesite is at a depth of about 55 inches.

About 10 percent of this unit is included areas of Hall Ranch and Klicker soils.

Permeability is moderately slow. Available water capacity is 9 to 17 inches. Water supplying capacity is 12 to 16 inches. Effective rooting depth is 40 to 60 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate.

This soil is used for timber production, range, recreation, and wildlife habitat.

This soil is suited to the production of Douglas-fir. At a site index of 78 (*5*), it is capable of producing about 3,250 cubic feet of timber from a fully stocked stand at 50 years or 34,240 board feet (Scribner) of merchantable timber from a fully stocked stand at 160 years.

Lodgepole pine also grows on this soil. At a site index of 80 (*9*), the soil is capable of producing 3,450 cubic feet of merchantable timber from a fully stocked, even-aged stand at 70 years or 19,700 board feet (Scribner) of merchantable timber from a fully stocked, even-aged stand at 100 years.

The slope and ash content are the main equipment limitations in harvesting timber. High lead or other cable logging systems should be used for tree harvest. Use of roads early in spring should be limited because the ash layer does not compact easily, has high potential frost action and a high water holding capacity, and it is generally poor roadbed material.

The native vegetation is mixed fir forest. The canopy cover is 40 to 70 percent. Western larch is subordinate in the stand. Under this canopy cover, the foliar understory is dominated by plants that do not provide significant forage for domestic livestock. It is about 20 percent small red huckleberry and princes pine, 10 percent twin flower, 5 percent pachistima, and about 5 percent forbs, mainly lupine, false Solomons-seal, and heartleaf arnica. Lodgepole pine occurs in some areas that have been affected by fire. The trees in these stands range from 75 to 100 years. The canopy cover generally is more than that in the mixed fir forest. The understory of shade tolerant shrubs, forbs, and grasses decreases as the tree cover increases but provides considerable forage as long as the tree stand remains open.

Following fire or logging, broadcast seeding is advisable before fall rains. A major objective of seeding is to stabilize disturbed soil areas. Suitable for seeding are orchardgrass, timothy, hard fescue, and white clover.

Mule deer use this plant community for food and cover in summer and autumn. Rocky Mountain elk use it for winter range and for cover during daytime and winter storms.

In most places community development is not practical because of the steep slopes.

The capability subclass is VIIe.

20B—Hezel loamy fine sand, 2 to 5 percent slopes. This is a very deep, somewhat excessively drained soil formed in water laid material. It is on terraces and uplands at elevations of 400 to 700 feet. The average slope is 3 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 150 to 200 days at 32 degrees and 185 to 285 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown loamy fine sand about 9 inches thick. The substratum is 21 inches of dark brown loamy fine sand over brown, compact, calcareous silt loam that extends to a depth of 60 inches or more.

About 15 percent of this unit is included areas of Burbank, Koehler, Quincy, and Royal soils and Dune land.

Permeability is rapid in the upper part of the substratum and moderately slow below. Effective rooting depth is 40 to 60 inches. Available water capacity is 4.5 to 9 inches. Water supplying capacity is 3 to 5 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. Some of the acreage is used for range and wildlife habitat. Major irrigated crops include potatoes, wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the proper application of irrigation water and protection against soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the moderately low water holding capacity in the upper part of the soil and the high water consumption, light, frequent applications of irrigation water are needed. Irrigation rates should be carefully determined. In many areas, compact, slowly permeable lacustrine silt is at a moderate depth. If these areas are overirrigated, ponding may result. In steeper areas of this unit, excess irrigation water may run off and cause some erosion.

The hazard of soil blowing is high because of the loamy fine sand surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and hummocks in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures needed to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Blowout areas require special treatment, such as disked-in straw mulching and seeding to suitable grasses. Doublecropping and stripcropping are needed in places. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation system before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is bluebunch wheatgrass, Sandberg bluegrass, and needleandthread. Perennial forbs, such as Carey balsamroot, wooly Indianwheat, and western yarrow, occur in small amounts. Big sagebrush and rubber rabbitbrush are common.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass, low value forbs, and big sagebrush increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass and rabbitbrush commonly dominate the stand.

If the range is in poor condition, seedbed preparation and seeding should be considered. Because the hazard of soil blowing is high, seeding to grass presents special management problems. Direct drill seeding after a fire is a good way to restore production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested or Siberian wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil is generally well suited to community development. Construction of dwellings, commercial buildings, and roads and streets is limited somewhat because of the low strength of the soil. Septic tanks may require modification in design because the soil is moderately slowly permeable. Recreation facilities are limited because the surface layer is too sandy. Playgrounds may require leveling.

The capability subclass is VIIe dryland, IVe irrigated.

20C—Hezel loamy fine sand, 5 to 12 percent slopes. This is a very deep, somewhat excessively drained soil formed in water laid material. It is on terraces and uplands at elevations of 400 to 700 feet. The average slope is 8 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost-free period is 150 to 200 days at 32 degrees and 185 to 215 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown loamy fine sand about 9 inches thick. The substratum is 21 inches of dark brown loamy fine sand over brown, compact, calcareous silt loam that extends to a depth of 60 inches or more.

About 15 percent of this unit is included areas of Burbank, Koehler, Quincy, and Royal soils and Dune land.

Permeability is rapid in the upper part of the substratum and moderately slow below. Effective rooting depth is 40 to 60 inches. Available water capacity is 4.5 to 9 inches. Water supplying capacity is 3 to 5 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. Some of the acreage is used for range and wildlife habitat. Major irrigated crops include potatoes, wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the proper application of irrigation water and protection from soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the moderately low water holding capacity in the upper part of the soil and the high water consumption, light, frequent applications of irrigation water are needed. Irrigation rates should be carefully determined. In many areas, compact, slowly permeable lacustrine silt is at a moderate depth. If these areas are overirrigated, soil erosion may result from the runoff of excess water.

The hazard of soil blowing is high because of the loamy fine sand surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and hummocks in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Practices needed to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction Blowout areas require special treatment, such as disked-in straw mulching and seeding to suitable grasses. Doublecropping and stripcropping are needed in places. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation systems before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is bluebunch wheatgrass, Sandberg bluegrass, and needleandthread. Perennial forbs, such as Carey balsamroot, wooly Indianwheat, and western yarrow, occur in small amounts. Big sagebrush and rubber rabbitbrush are common.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass, low value forbs, and big sagebrush increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass and rabbitbrush commonly dominate the stand.

If the range is in poor condition, seedbed preparation and seeding should be considered. Because the soil blowing hazard is high, seeding to grass presents special management problems. Direct drill seeding after a fire is a good way to restore production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested or Siberian wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

Construction of dwellings, commercial buildings, and roads and streets is limited somewhat because of the low strength of the soil and the slope. Septic tanks may require modification in design because the soil is moderately slowly permeable. Sewage lagoons are severely limited because of the slope. Recreation facilities are limited because the surface layer is too sandy. Playgrounds may require leveling.

The capability subclass is VIe dryland, IVe irrigated.

21B—Irrigon fine sandy loam, 2 to 5 percent slopes. This is a moderately deep, well drained soil formed in alluvial sand derived from basaltic and quartzitic material. It is on terraces at elevations of 400 to 700 feet. The average slope is 3 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 160 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown fine sandy loam about 3 inches thick. The subsoil is dark brown fine sandy loam and loam about 20 inches thick. Depth to semiconsolidated sandy sediment is about 23 inches.

About 20 percent of this unit is included areas of Hezel soils and shallow fine sandy loams and 10 percent is Ellum and Quincy soils.

Permeability is moderate. Effective rooting depth is restricted by the semiconsolidated sandy sediment at a depth of 20 to 40 inches. Available water capacity is 3 to 6.5 inches. Water supplying capacity is 2 to 5 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. Some of the acreage is used as range and wildlife habitat. Major irrigated crops include potatoes, corn, wheat, alfalfa hay, and pasture.

Major concerns in management are the hazard of soil blowing and the proper application of irrigation water. Where water is available, irrigation is by sprinklers, commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the high water consumption and moderate water holding capacity, light, frequent applications of irrigation water are needed. Overirrigation should be avoided because of the impervious material at a depth of 20 to 40 inches. Ponding may result, and in the steeper areas of this unit runoff may occur causing some erosion.

The hazard of soil blowing is moderate because of the fine sandy loam surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help control soil blowing are winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation systems before land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is dominated by bluebunch wheatgrass, Sandberg bluegrass, and needleandthread. Perennial forbs, such as Carey balsamroot, wooly Indianwheat, and western yarrow, occur in small amounts. Big sagebrush and rubber rabbitbrush commonly occur.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass, low value forbs, and big sagebrush increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass and rabbitbrush commonly dominate the stand.

If the range is in poor condition, seedbed preparation and seeding should be considered. Because the soil blowing hazard is high, seeding to grass presents special management problems. Direct drill seeding after a fire is a good way to restore production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested or Siberian wheatgrass.

Livestock grazing should be limited primarily to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

Construction of sanitary facilities may require variation in design because of the depth to bedrock. Construction of dwellings, commercial buildings, and roads and streets is limited somewhat because of the depth to rock and low strength of the soil. Playgrounds may require leveling.

The capability subclass is VIe dryland, IIIe irrigated.

21C—Irrigon fine sandy loam, 5 to 12 percent slopes. This is a moderately deep, well drained soil formed in alluvial sand derived from basaltic and quartzitic material. It is on terraces at elevations of 400 to 700 feet. The average slope is 8 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 160 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown fine sandy loam about 3 inches thick. The subsoil is dark brown fine sandy loam and loam about 20 inches thick. Depth to semiconsolidated sandy sediment is about 23 inches.

About 20 percent of this unit is included areas of Hezel soils and shallow fine sandy loams, and 10 percent is Ellum and Quincy soils.

Permeability is moderate. Effective rooting depth is restricted by semiconsolidated sandy sediment at a depth of 20 to 40 inches. Available water capacity is 3 to 6.5 inches. Water supplying capacity is 2 to 5 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. Some of the acreage is used as range and wildlife habitat. Major irrigated crops include potatoes, corn, wheat, alfalfa hay, and pasture.

Major concerns in management are the hazard of soil blowing and the proper application of irrigation water. Where water is available, irrigation is by sprinklers, commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the high water consumption and moderate water holding capacity, light, frequent applications of irrigation water are needed. Overirrigation should be avoided because of the impervious material at a depth of

20 to 40 inches. Excess irrigation water may run off and result in some erosion.

The hazard of soil blowing is moderate because of the fine sandy loam surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered and applied chemicals are lost. Measures that help in controlling soil blowing are winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation systems before land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are practices and precautions needed.

The native plant community is dominated by bluebunch wheatgrass, Sandberg bluegrass, and needleandthread. Perennial forbs, such as Carey balsamroot, wooly Indianwheat, and western yarrow, occur in small amounts. Big sagebrush and rubber rabbitbrush are common.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass, low value forbs, and big sagebrush increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass and rabbitbrush commonly dominate the stand.

If the range is in poor condition, seedbed preparation and seeding should be considered. Because soil blowing is a moderate hazard, seeding to grass presents special management problems. Direct drill seeding after a fire is a good way to restore production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested or Siberian wheatgrass.

Livestock grazing should be limited primarily to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

Construction of sanitary facilities may require variation in design because of the depth to bedrock. Construction of dwellings, commercial buildings, and roads and streets is limited somewhat because of the depth to rock, low strength of the soil, and slope. Recreation facilities are limited by the slope. Playgrounds may require leveling.

The capability subclass is VIe dryland, IVe irrigated.

22—Kimberly fine sandy loam. This is a very deep, well drained soil on alluvial bottom land adjacent to streams at elevations of 500 to 1,200 feet. It formed in a mixture of loess, silty alluvium, and volcanic ash. Slopes range from 0 to 3 percent but average 1 percent. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 51 to 53 degrees F. The frost free period is 140 to 180 days at 32 degrees.

In a representative profile the surface layer is dark brown and very dark grayish brown fine sandy loam about 15 inches thick. The subsoil is dark brown and brown fine sandy loam and sandy loam about 18 inches thick. The substratum is brown and dark grayish brown sandy loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Esquatzel soils and Xeric Torriorthents, and 5 percent is Endersby and Onyx soils.

Permeability is moderately rapid. Effective rooting depth is 40 to more than 60 inches. Available water capacity is 6 to 9 inches. Water supplying capacity is 8 to 11 inches. Runoff is slow, and the hazard of erosion is slight. The soil is subject to rare flooding.

All the acreage is used for irrigated crops. Hay and pasture are the main crops. Some winter wheat is also grown.

The major needs in irrigated crop management are the proper timing and rates of applying irrigation water. Stabilizing streambanks against cutting by water is also important. Irrigation is by sprinklers, most commonly wheelline or handline systems.

In irrigated areas, a suitable cropping system is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Because of the moderately rapid permeability and high water consumption, light, frequent applications of irrigation water are needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the root zone by the irrigation water.

Streambanks can be stabilized by maintaining streamside vegetation, especially giant wildrye and riparian shrubs such as lilac or willow. Such vegetation also provides important wildlife cover.

Areas of this soil provide important food and cover for upland game birds, such as ring-necked pheasant and valley quail. Mule deer and small mammals use these areas for food and cover.

This soil occurs on stream flood plains and is subject to rare flooding, which results in limitations for many community developments. It is well suited to recreation facilities, except campgrounds, where flooding may be a problem, and playgrounds, where the slope is a limitation.

The capability subclass is I irrigated.

23D—Klicker stony silt loam, 2 to 20 percent slopes. This is a moderately deep, well drained soil formed in wind laid silt and volcanic ash mixed with basalt colluvium. It occurs at elevations of 3,500 to 5,300 feet in the Blue Mountains. The average slope is 9 percent. The average annual precipitation is 20 to 28 inches, and the average annual air temperature is 43 to

45 degrees F. The frost free period is 60 to 90 days at 32 degrees.

In a representative profile the surface layer is dark reddish brown stony silt loam that grades to cobbly silt loam. It is 11 inches thick. The subsoil is dark reddish brown and dark brown very cobbly silty clay loam about 15 inches thick. Fractured basalt is at a depth of about 26 inches.

About 20 percent of this unit is included areas of Hall Ranch soils; 10 percent is Tolo, Helter, Boardtree, and Hankins soils; and 5 percent is Bocker soils.

Permeability is moderately slow. Effective rooting depth is 20 to 40 inches. Available water capacity is 3 to 6 inches. Water supplying capacity is 8 to 16 inches. Runoff is medium, and the hazard of erosion is slight to moderate.

This soil is used for timber production, range, recreation, and wildlife habitat.

This soil is suited to the production of ponderosa pine. At a site index of 68 (*8*), it is capable of producing about 2,650 cubic feet of timber from a fully stocked stand at 50 years or 31,540 board feet (Scribner) of merchantable timber from a fully stocked stand at 190 years.

This soil is well suited to tractor logging. Construction and maintenance of roads are fairly easy because slopes are gentle and the soil material is good subgrade for construction. The amount of ballast depends upon number and type of vehicles using the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is ponderosa pine. In a moderately stocked, mixed-age stand, the tree canopy cover is 10 to 40 percent. The understory is dominated by Idaho fescue and bluebunch wheatgrass. A variety of perennial forbs, such as peavine and arrowleaf balsamroot, occurs throughout the stand. A few shrubs occur in small amounts.

As the understory deteriorates, the proportion of forbs and less desirable grasses increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated, much of the surface is left bare, and the hazard of soil erosion is high, especially on the steeper slopes.

Following fire or logging, broadcast seeding is advisable before fall rains. A major objective of seeding is to stabilize disturbed soil areas. Plants suitable for seeding are intermediate wheatgrass, big bluegrass, crested wheatgrass, and hard fescue.

This plant community is used in summer and fall by mule deer. It is also an important part of the winter range of Rocky Mountain elk. A variety of small mammals and birds, including game birds such as the blue and ruffed grouse, use this community.

The depth to bedrock and the slope are limitations for community developments and recreation facilities. Variations in design should be carefully implemented for successful utilization of this soil.

The capability subclass is VIe.

24E—Klicker stony silt loam, 20 to 40 percent north slopes. This is a moderately deep, well drained soil formed in wind laid silt and volcanic ash mixed with basalt colluvium. It is on north-facing slopes in the Blue Mountains at elevations of 3,500 to 4,600 feet. The average slope is 30 percent. The average annual precipitation is 20 to 28 inches, and the average annual air temperature is 43 to 45 degrees F. The frost free period is 60 to 90 days at 32 degrees.

In a representative profile the surface layer is dark reddish brown stony silt loam about 11 inches thick. The subsoil is dark reddish brown and dark brown very cobbly clay loam about 15 inches thick. Fractured basalt is at a depth of about 26 inches.

About 20 percent of this unit is included areas of closely similar soils that are more than 40 inches thick; 5 percent is skeletal, ashy soils; 20 percent is Hall Ranch soils; and 15 percent Snell, Hankins, Boardtree, Tolo, and Helter soils.

Permeability is moderately slow. Effective rooting depth is 20 to 40 inches. Available water capacity is 3 to 6 inches. Water supplying capacity is 8 to 16 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for timber production, range, recreation, and wildlife habitat.

This soil is suited to the production of ponderosa pine. At a site index of 79 (*8*), it is capable of producing about 3,350 cubic feet of timber from a fully stocked stand at 50 years or 35,040 board feet (Scribner) of merchantable timber from a fully stocked stand at 160 years.

Tractor logging is practical in the less steep areas of this unit. In most places, however, cable logging is desirable because of the slope. Steep slopes are concerns in the construction and maintenance of roads. The soil material provides good subgrade for roads. The amount of ballast depends upon the number and type of vehicles using the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is fir and ponderosa pine. Fir is predominant. Western larch commonly occurs in lesser amounts. The tree canopy is about 40 percent. Under this canopy, the foliar understory provides little forage for domestic livestock. It is about 40 percent elk sedge and about 2 percent each a variety of shrubs, such as snowberry and rose. It is about 5 percent peavine, a prominent forb. In open grown stands, elk sedge, pinegrass, and a variety of palatable forbs, such as peavine, provide considerable forage as long as the canopy remains open.

Following fire or logging, broadcast seeding is advisable before fall rains. A major objective of seeding is to stabilize disturbed soil areas. Plants suitable for seeding are orchardgrass, timothy, hard fescue, and white clover.

Mule deer use the plant community for food and cover in summer and fall. At the lower elevations, Rocky

Mountain elk use it as winter range, mainly as cover during daytime and winter storms. A variety of small mammals and birds, including game birds such as the blue and ruffed grouse, also use this plant community.

The depth to bedrock, the stones, and the slope are limitations to community development and recreation facilities. Extensive variations in design need to be carefully implemented for successful utilization of this soil.

The capability subclass is VIIs.

24F—Klicker stony silt loam, 40 to 75 percent north slopes. This is a moderately deep, well drained soil formed in wind laid silt and volcanic ash mixed with basalt colluvium. It is on north-facing slopes in the Blue Mountains at elevations of 3,500 to 4,600 feet. The average slope is 55 percent. The average annual precipitation is 20 to 28 inches, and the average annual air temperature is 43 to 45 degrees F. The frost free period is 60 to 90 days at 32 degrees F.

In a representative profile, the surface layer is dark reddish brown stony silt loam about 11 inches thick. The subsoil is dark reddish brown and dark brown very cobbly silty clay loam about 15 inches thick. Fractured basalt is at a depth of about 26 inches.

About 20 percent of this unit is included areas of closely similar soils that are more than 40 inches thick; 5 percent is skeletal, ashy soils; and 15 percent is Snell, Hankins, Boardtree, Tolo, and Helter soils.

Permeability is moderately slow. Effective rooting depth is 20 to 40 inches. Available water capacity is 3 to 6 inches. Water supplying capacity is 8 to 16 inches. Runoff is rapid, and the hazard of erosion is high.

This soil is used for timber production, range, recreation, and wildlife habitat.

This soil is suited to the production of ponderosa pine. At a site index of 79 (*8*), it is capable of producing about 3,350 cubic feet of timber from a fully stocked stand at 50 years or 35,040 board feet (Scribner) of merchantable timber from a fully stocked stand at 160 years.

Because of the slope, the only practical method of logging is by cable. In some areas, outcrops of rock may interfere with logging. Steep slopes are the most serious concern in the construction and maintenance of roads. The soil material provides good subgrade for roads. The amount of ballast depends upon the number and type of vehicles using the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is fir and ponderosa pine. Fir is dominant. Western larch commonly occurs in lesser amounts. The tree canopy cover is about 40 percent. Under this canopy cover the foliar understory provides little forage for domestic livestock. It is about 40 percent elk sedge and about 4 percent a variety of shrubs, such as snowberry and rose. It is about 5 percent peavine, a prominent forb. In open grown stands, elk sedge, pinegrass, and a variety of palatable forbs, such as peavine, provide considerable forage as long as the canopy remains open.

Following fire or logging, broadcast seeding is advisable before fall rains. A major objective of seeding is to stabilize disturbed soil areas. Plants suitable for seeding are orchardgrass, timothy, hard fescue, and white clover.

Mule deer use this plant community for food and cover in summer and fall. At the lower elevations, Rocky Mountain elk use it as winter range, mainly as cover during daytime and winter storms. A variety of other mammals and birds, including game birds such as blue and ruffed grouse, also use this community.

The depth to bedrock, the surface stones, and the very steep slopes are limitations for community developments and recreation facilities, and such uses generally are not practical.

The capability subclass is VIIs.

25E—Klicker very stony silt loam, 20 to 40 percent south slopes. This is a moderately deep, well drained soil formed in wind laid silt and volcanic ash mixed with basalt colluvium. It occurs at elevations of 3,500 to 5,300 feet in the Blue Mountains. The average slope is 30 percent. The average annual precipitation is 20 to 28 inches, and the average annual air temperature is 43 to 45 degrees F. The frost-free period is 60 to 90 days at 32 degrees.

In a representative profile the surface layer is dark reddish brown very stony silt loam about 11 inches thick. The subsoil is dark reddish brown and dark brown very cobbly silty clay loam about 15 inches thick. Fractured basalt is at a depth of about 26 inches.

About 15 percent of this unit is included areas of Hall Ranch soils; 5 percent is Tolo, Helter, Boardtree, Hankins, and steep Klicker soils; and 10 percent is Gwin soils.

Permeability is moderately slow. Effective rooting depth is 20 to 40 inches. Available water capacity is 3 to 6 inches. Water supplying capacity is 8 to 16 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for timber production, range, recreation, and wildlife habitat.

This soil is suited to the production of ponderosa pine. At a site index of 68 (*8*), it is capable of producing about 2,650 cubic feet of timber from a fully stocked stand at 50-years or 31,540 board feet (Scribner) of merchantable timber from a fully stocked stand at 190 years.

Tractor logging is practical on the less steep areas of this unit. In most cases, however, cable logging is desirable because of the slope. Steep slopes are the biggest concern in the construction and maintenance of roads. The soil provides good subgrade for construction. The amount of ballast depends upon the number and type of vehicles using the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is a ponderosa pine woodland community. In a moderately stocked, mixed-age stand, the tree canopy cover is 10 to 40 percent. The understory is dominated by Idaho fescue and bluebunch wheatgrass. A variety of perennial forbs, such as peavine and arrowleaf balsamroot, occurs throughout the stand. A few shrubs occur in small amounts.

If the understory deteriorates, the proportion of forbs and less desirable grasses increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated, much of the surface is left bare, and the hazard of soil erosion is high, especially on the steeper slopes.

Following fire or logging, broadcast seeding is advisable before fall rains. A major objective of seeding is to stabilize disturbed soil areas. Plants suitable for seeding are intermediate wheatgrass, big bluegrass, crested wheatgrass, and hard fescue.

This plant community is used in summer and fall by mule deer. It is also an important part of the winter range of Rocky Mountain elk. A variety of small mammals and birds, including game birds such as blue and ruffed grouse, use this community.

The depth to bedrock, the surface stones, and the slope are limitations for community developments and recreation facilities. Extensive variations in design should be carefully implemented for successful utilization of this soil.

The capability subclass is VIIs.

25F—Klicker very stony silt loam, 40 to 75 percent south slopes. This is a moderately deep, well drained soil formed in wind laid silt and volcanic ash mixed with basalt colluvium. It occurs at elevations of 3,500 to 5,300 feet in the Blue Mountains. The average slope is 55 percent. The average annual precipitation is 20 to 28 inches, and the average annual air temperature is 43 to 45 degrees F. The average frost free period is 60 to 90 days at 32 degrees.

In a representative profile the surface layer is dark reddish brown very stony silt loam about 11 inches thick. The subsoil is dark reddish brown and dark brown very cobbly silty clay loam about 15 inches thick. Fractured basalt is at a depth of about 26 inches.

About 15 percent of this unit is included areas of Gwin soils, and 5 percent is Tolo and Helter soils.

Permeability is moderately slow. Effective rooting depth is 20 to 40 inches. Available water capacity is 3 to 6 inches. Water supplying capacity is 8 to 16 inches. Runoff is rapid, and the hazard of erosion is severe.

This soil is used for timber production, range, recreation, and wildlife habitat.

This soil is suited to the production of ponderosa pine. At a site index of 68 (*8*), it is capable of producing about 2,650 cubic feet of timber from a fully stocked stand at 50 years or 31,540 board feet (Scribner) of merchantable timber from a fully stocked stand at 190 years.

Because of the slope, the only practical method of logging is by cable. In some areas, outcrops of rock may interfere with logging. Steep slopes are the serious concern in the construction and maintenance of roads. The soil material provides good subgrade for construction. The amount of ballast depends upon the number and type of vehicles using the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is a ponderosa pine woodland community. In a moderately stocked, mixed-age stand, the canopy cover is 10 to 40 percent. The understory is dominated by Idaho fescue and bluebunch wheatgrass. A variety of perennial forbs, such as peavine and arrowleaf balsamroot, occurs throughout the stand. A few shrubs occur in small amounts.

If the understory deteriorates, the proportion of forbs and less desirable grasses increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated, much of the surface is left bare, and the hazard of soil erosion is high, especially on the steeper slopes.

Following fire or logging, broadcast seeding is advisable before fall rains. A major objective of seeding is to stabilize disturbed soil areas. Plants suitable for seeding are intermediate wheatgrass, big bluegrass, crested wheatgrass, and hard fescue.

This plant community is used in summer and fall by mule deer. It is also an important part of the winter range of Rocky Mountain elk. A variety of small mammals and birds, including game birds such as blue and ruffed grouse, also use this community.

The use of this soil for community developments and recreation facilities is impractical because of the depth to bedrock, the surface stones, and the very steep slopes.

The capability subclass is VIIs.

26B—Koehler loamy fine sand, 2 to 5 percent slopes. This is a moderately deep, excessively drained soil formed in mixed sand. It occurs at elevations of 400 to 800 feet. The average slope is 3 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 150 to 200 days at 32 degrees and 185 to 215 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown loamy fine sand about 4 inches thick. The substratum is about 20 inches of brown and dark brown loamy fine sand over 4 inches of dark grayish brown loamy fine sand. A calcareous hardpan is at a depth of about 28 inches.

About 20 percent of this unit is included areas of Quinton, Hezel, and Burbank soils and 5 percent is Quincy and Royal soils and Dune land.

Permeability is rapid above the pan. Effective rooting depth is restricted by the pan at a depth of 20 to 40 inches. Available water capacity is 2 to 4 inches Water supplying capacity is 2 to 4 inches. Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. A large part of the acreage is used for range and wildlife habitat, particularly where the soil occurs within the Boardman Naval Reservation. Major irrigated crops include potatoes, wheat, corn, alfalfa hay, and pasture

Major concerns in management are the proper application of irrigation water and the hazard of soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the moderately low water holding capacity and high water consumption, light, frequent applications of irrigation water are needed. Care should be taken not to overirrigate. In several areas of this soil near Boardman, overirrigation has resulted in a high water table.

The hazard of soil blowing is high because of the loamy fine sand surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and hummocks in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures needed to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Blowout areas require special treatment, such as disked-in straw mulching and seeding to suitable grasses. Doublecropping and stripcropping are needed in places. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation system before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is dominated by needleandthread and Indian ricegrass. Antelope bitterbrush is common and is prominent in places. Perennial forbs, such as Columbia milkvetch and Carey balsamroot, are common. Other shrubs, such as big sagebrush and rabbitbrush, occur here and there in small amounts.

If range condition deteriorates, the proportion of Indian ricegrass decreases and the proportion of needleandthread and low value forbs increases. If deterioration is severe, cheatgrass invades and strongly dominates the stand. As a result, the hazard of soil blowing during the growing season is severe, and sand movement may be difficult to control.

If the range is in poor condition, total protection of the existing plant cover should be considered. Standard methods of seedbed preparation and seeding present special problems because of the hazard of soil blowing. Direct drill seeding of crested wheatgrass or Siberian wheatgrass is advisable after a fire.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil is limited for sanitary facilities by the cemented pan and seepage. It is generally well suited to construction of dwellings, roads and streets, and commercial buildings. Dwellings with basements, however, may require some variation in design because of the cemented pan. The soil is limited for recreation facilities because the surface layer is too sandy. Playgrounds may require leveling.

The capability subclass is VIIe dryland, IVe irrigated.

26C—Koehler loamy fine sand, 5 to 12 percent slopes. This is a moderately deep, excessively drained soil formed in mixed sand. It occurs at elevations of 400 to 800 feet. The average slope is 8 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 150 to 200 days at 32 degrees and 185 to 215 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown loamy fine sand about 4 inches thick. The substratum is about 20 inches of brown and dark brown loamy fine sand over 4 inches of dark grayish brown loamy fine sand. A calcareous hardpan is at a depth of 28 inches

About 20 percent of this unit is included areas of Quinton, Hezel, and Burbank soils and 5 percent is Quincy and Royal soils and Dune land.

Permeability is rapid above the pan. Effective rooting depth is restricted by the pan at a depth of 20 to 40 inches. Available water capacity is 2 to 4 inches. Water supplying capacity is 2 to 4 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. A large part of the acreage is used for range and wildlife habitat, particularly where the soil occurs in the Boardman Naval Reservation. Major irrigated crops include potatoes, wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the proper application of irrigation water and the hazard of soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the moderately low water holding capacity and high water consumption, light, frequent applications of irrigation water are needed. Care should be taken not to overirrigate. In several areas of this soil near Boardman, overirrigation has resulted in a high water table.

The hazard of soil blowing is high because of the loamy fine sand surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and hummocks in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures needed to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind. Blowout areas require special treatment, such as disked-in straw mulching and seeding to suitable grasses. Doublecropping and stripcropping are needed in places. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation systems before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is dominated by needleandthread and Indian ricegrass. Antelope bitterbrush is common and is prominent in places. Perennial forbs, such as Columbia milkvetch and Carey balsamroot, are common. Other shrubs, such as big sagebrush and rabbitbrush, occur in small amounts.

If range condition deteriorates, the proportion of Indian ricegrass decreases and the proportion of needleandthread and low value forbs increases. If deterioration is severe, cheatgrass invades and strongly dominates the stand. As a result, the hazard of soil blowing during the growing season is severe, and sand movement may be difficult to control.

If the range is in poor condition, total protection of the existing plant cover is a practical consideration. Standard methods of seedbed preparation and seeding present special problems because of the hazard of soil blowing. Direct drill seeding of crested wheatgrass or Siberian wheatgrass is advisable.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil is limited for sanitary facilities by the cemented pan and the seepage. It is generally well suited to construction of dwellings and roads and streets, but some modification in design may be needed because of the slope and the pan. Commercial buildings are limited by the slope. Recreation facilities are limited because the surface layer is too sandy. Playgrounds may require leveling.

The capability subclass is VIIe dryland, IVe irrigated.

27E—Labuck loam, 5 to 35 percent slopes. This is a moderately deep, well drained soil formed in colluvium from granodiorite. It is on ridgetops and south-facing slopes in the Blue Mountains at elevations of 3,500 to 4,500 feet. The average slope is 25 percent. The average annual precipitation is 20 to 25 inches, and the average annual air temperature is 42 to 45 degrees F. The frost free period is 50 to 90 days at 32 degrees and 80 to 110 days at 28 degrees.

In a representative profile the surface layer is dark brown loam about 6 inches thick. The subsoil is yellowish brown gravelly loam and loam about 15 inches thick. The substratum is dark yellowish brown gravelly sandy loam about 10 inches thick. Weathered granodiorite is at a depth of about 31 inches.

About 15 percent of this unit is included areas of Hall Ranch and Tolo soils and 2 percent is granitic Rock outcrop.

Permeability is moderate. Effective rooting depth is restricted by the granodiorite at a depth of 20 to 40 inches. Available water capacity is 2 to 6 inches. Water supplying capacity is 8 to 16 inches. Runoff is slow to rapid, and the hazard of water erosion is slight to high.

This soil is used for timber, range, recreation, and wildlife habitat.

This soil is suited to the production of ponderosa pine. At a site index of 61 (*8*), it is capable of producing about 2,350 cubic feet of timber from a fully stocked stand at 50 years or 25,300 board feet (Scribner) of merchantable timber from a fully stocked stand at 190 years.

Tractor logging is suitable in most areas. On slopes of more than 30 percent, cable logging may be desirable. The soil material provides fair subgrade for roads. If roads are not sealed and ballasted, however, they will erode easily, particularly if they are used in spring. The amount of ballast depends on the number and type of vehicles using the road and the months of the year that the road is used. Use early in spring should be limited. Some abandoned landings and skid roads require seeding to reduce erosion.

The native vegetation is ponderosa pine and Douglas-fir. Pine is dominant. In a moderately stocked, mixed-age stand, the canopy cover is 20 to 40 percent. Douglas-fir reproduction may dominate tree regeneration in places. The understory is a good stand of elk sedge, Idaho fescue, pinegrass, and a variety of perennial forbs. Shrubs, such as bearberry, snowberry, and shinyleaf spirea, are prominent.

If the understory deteriorates, elk sedge and the desirable bunchgrasses decrease and the proportion of forbs and shrubs increases. If deterioration is severe, the productive forage plants are nearly eliminated, much of the surface is left bare, and the hazard of erosion is high, especially on steep slopes.

Following fire or logging, broadcast seeding is desirable before fall rains. A major objective of seeding is to stabilize disturbed areas. Plants suitable for seeding are intermediate wheatgrass, smooth bromegrass, and hard fescue.

This plant community is used in summer by mule deer. It is an important part of the winter range of Rocky Mountain elk. A variety of small mammals and birds, including game birds such as blue and ruffed grouse, also use this community.

Very few dwellings are on this soil, and the majority are used for seasonal recreation purposes. Because of the slope and depth to rock, construction of dwellings, buildings, and sanitary and recreation facilities may require modifications for successful development.

The capability subclass is VIe.

28E—Lickskillet very stony loam, 7 to 40 percent slopes. This is a shallow, well drained soil formed in material weathered from loess and colluvium. It occurs on south- and west-facing slopes at elevations of 800 to 3,500 feet. The average slope is 20 percent. The average annual precipitation is 10 to 13 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free period is 100 to 150 days at 32 degrees and 150 to 210 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown very stony loam about 2 inches thick. The subsoil is dark brown extremely cobbly heavy loam about 15 inches thick. Fractured basalt is at a depth of about 17 inches.

About 20 percent of this unit is included areas of Bakeoven soils and basalt outcrop and 10 percent is Mikkalo, Valby, Morrow, and Wrentham soils.

Permeability is moderate. Effective rooting depth is 12 to 20 inches. Available water capacity is 1 to 3 inches. Water supplying capacity is 2 to 5 inches. Runoff is rapid, and the hazard of erosion is high.

This soil is used for livestock grazing and wildlife habitat.

The major concern is maintaining an adequate plant cover for control of water erosion.

The native plant community is dominated by bluebunch wheatgrass. Sandberg bluegrass and Thurber needlegrass are prominent. Various perennial forbs occur throughout the stand in small amounts. Shrubs are minor in the stand.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and Thurber needlegrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, much of the surface is left bare and the hazard of soil erosion is high.

Because the soil is shallow and stony, seedbed preparation and range seeding generally are not practical.

Most areas of this soil provide some food and cover for mule deer, small mammals, and game birds.

The depth to bedrock, stoniness, and slope are severe limitations for community and recreation uses. Extensive design modifications are needed but in most cases are not practical for dwellings, small buildings, and sanitary facilities.

The capability subclass is VIIs.

29F—Lickskillet-Rock outcrop complex, 40 to 70 percent slopes. This map unit is on south-facing slopes of uplands at elevations of 800 to 3,500 feet. It is about 55 percent Lickskillet soil, 25 percent Rock outcrop, 15 percent Bakeoven soil and Rubble land, and 5 percent Nansene and Wrentham soils. The Lickskillet soil is shallow and well drained. It formed in material weathered from loess and colluvium. The average slope is about 50 percent. The average annual precipitation is 10 to 13 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free period is 100 to 150 days at 32 degrees and 150 to 210 days at 28 degrees.

In a representative profile of the Lickskillet soil the surface layer is very dark grayish brown extremely stony loam about 2 inches thick. The subsoil is dark brown extremely cobbly heavy loam about 15 inches thick. Fractured basalt is at a depth of about 17 inches.

Rock outcrop is basalt bedrock.

The Lickskillet soil has moderate permeability. Effective rooting depth is 12 to 20 inches. Available water capacity is 1 to 3 inches. Water supplying capacity is 2 to 5 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for livestock grazing and wildlife habitat.

The native vegetation is a plant community dominated by bluebunch wheatgrass. Sandberg bluegrass and Thurber needlegrass are prominent. A variety of perennial forbs and a few shrubs occur in small amounts.

If range condition deteriorates, plant vigor is greatly reduced and the proportion of bluebunch wheatgrass and other desirable grasses decreases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, low value plants predominate, the soils are subject to erosion, and much of the surface is bare and rocky.

Because this unit is very stony and slopes are very steep, range seeding is not practical.

Most areas of this soil provide some food and cover for mule deer, small mammals, and game birds.

The shallow depth to bedrock, Rock outcrop, stoniness, and very steep slopes are severe limitations for community and recreation uses. Extreme design modifications are needed but are rarely practical for dwellings, small buildings, and sanitary facilities.

The capability subclass is VIIs.

30B—Mikkalo silt loam, 2 to 7 percent slopes. This is a moderately deep, well drained soil formed in loess. The elevation is 1,000 to 2,500 feet. The average slope is 4 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 13 inches thick. The subsoil is brown and pale brown silt loam about 17 inches thick. The substratum is pale brown silt loam about 5 inches thick. Fractured basalt is at a depth of about 35 inches.

About 15 percent of this unit is included areas of Ritzville and Willis soils and 5 percent is Lickskillet and Bakeoven soils.

Permeability is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is 3.5 to 8 inches. Water supplying capacity is 6.5 to 8 inches. Runoff is slow, and the hazard of erosion is slight.

Nearly all areas of this soil are dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland and irrigated hay and pasture are grown. Other areas are used for range and wildlife habitat.

The major need in crop management is conserving soil moisture.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Cross-slope tillage in the more level areas and diversions in the steeper areas are desirable, particularly where slopes are long.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

Suitable plants for seeding grassed waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass. For dryland hay and pasture, suitable grasses and legumes grown alone or in combination are alfalfa, crested wheatgrass, Siberian wheatgrass, beardless wheatgrass, and big bluegrass (*3*).

The native plant community is dominated by bluebunch wheatgrass and Sandberg wheatgrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is bare.

If the range is in poor condition, seeding is practical. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

The depth to bedrock is a limitation for community uses. Design modifications are needed for dwellings, small buildings, and sanitary facilities. This soil has no serious limitations for most recreation facilities. The depth to bedrock can be a limitation for playgrounds.

The capability subclass is IIIe dryland and irrigated.

30C—Mikkalo silt loam, 7 to 12 percent slopes. This is a moderately deep, well drained soil formed in loess. The elevation is 1,000 to 2,500 feet. The average slope is 9 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 13 inches thick. The subsoil is brown and pale brown silt loam about 17 inches thick. The substratum is pale brown silt loam about 5 inches thick. Fractured basalt is at a depth of about 35 inches.

About 15 percent of this unit is included areas of Ritzville and Willis soils and 5 percent is Lickskillet and Bakeoven soils.

Permeability is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is 3.5 to 8 inches. Water supplying capacity is 6.5 to 8 inches. Runoff is medium, and the hazard of erosion is moderate.

Most areas of this soil are dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland and irrigated hay and pasture are grown. Other areas are used for range and wildlife habitat.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch, minimum tillage, and grassed waterways in combination with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Cross-slope tillage, contour tillage, and diversions are generally needed to prevent erosion during high intensity rainfall or snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

Suitable for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass. For dryland hay, suitable grasses and legumes grown alone or in combination are alfalfa, crested wheatgrass, Siberian wheatgrass, beardless wheatgrass, and big bluegrass (*3*).

The native plant community is dominated by bluebunch wheatgrass and Sandberg bluegrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is left bare.

If the range is in poor condition, seeding is practical. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

The slope and depth to bedrock are limitations for community and recreation uses. Modifications in design are needed for dwellings, small buildings, sanitary facilities, and recreation facilities.

The capability subclass is IIIe dryland and irrigated.

30D—Mikkalo silt loam, 12 to 20 percent slopes. This is a moderately deep, well drained soil formed in loess. The elevation is 1,000 to 2,500 feet. The average slope is 15 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 13 inches thick. The subsoil is brown and pale brown silt loam about 17 inches thick. The substratum is pale brown silt loam about 5 inches thick. Fractured basalt is at a depth of about 35 inches.

About 15 percent of this unit is included areas of Ritzville and Willis soils and 10 percent is Lickskillet and Bakeoven soils.

Permeability is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is 3.5 to 8 inches. Water supplying capacity is 6.5 to 8 inches. Runoff is medium, and the hazard of erosion is moderate.

About half the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. Other areas are used for range and wildlife habitat.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch and minimum tillage in combination with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage and diversions help to prevent severe erosion during high intensity rainfall and snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

For dryland hay and pasture, suitable grasses and legumes grown alone or in combination are alfalfa, crested wheatgrass, Siberian wheatgrass, beardless wheatgrass, and big bluegrass (*3*).

The native plant community is dominated by bluebunch wheatgrass and Sandberg bluegrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is bare.

If the range is in poor condition, seedbed preparation and seeding are practical. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, game birds, and songbirds.

The slope and depth to bedrock are limitations for community and recreation uses. Extensive design modifications are needed for dwellings, small buildings, and sanitary and recreation facilities.

The capability subclass is IVe dryland.

31B—Morrow silt loam, 1 to 7 percent slopes. This is a moderately deep, well drained soil on uplands at elevations of 2,200 to 3,500 feet. It formed in wind laid silt. The average slope is 4 percent. The average annual precipitation is 12 to 14 inches, and the average annual air temperature is 46 to 50 degrees F. The frost free period is 110 to 140 days at 32 degrees and 150 to 190 days at 28 degrees.

In a representative profile the surface layer is very dark brown silt loam about 9 inches thick. The subsoil is dark brown silty clay loam that grades to heavy silt loam. It is about 10 inches thick. The substratum is dark brown silt loam about 7 inches thick. Fractured basalt is at a depth of about 26 inches.

About 15 percent of this unit is included areas of Bakeoven and Lickskillet soils.

Permeability is moderately slow. Effective rooting depth is restricted by the underlying bedrock at a depth of 20 to 40 inches. Available water holding capacity is 4 to 8.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is slow, and the hazard of erosion is slight.

Nearly all the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. Other areas are used for range and wildlife habitat.

The major need in crop management is conserving soil moisture.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system help to maintain soil moisture. Cross-slope tillage in the more level areas and contour tillage and diversions in the steeper areas are desirable, especially where slopes are long (fig. 7).

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

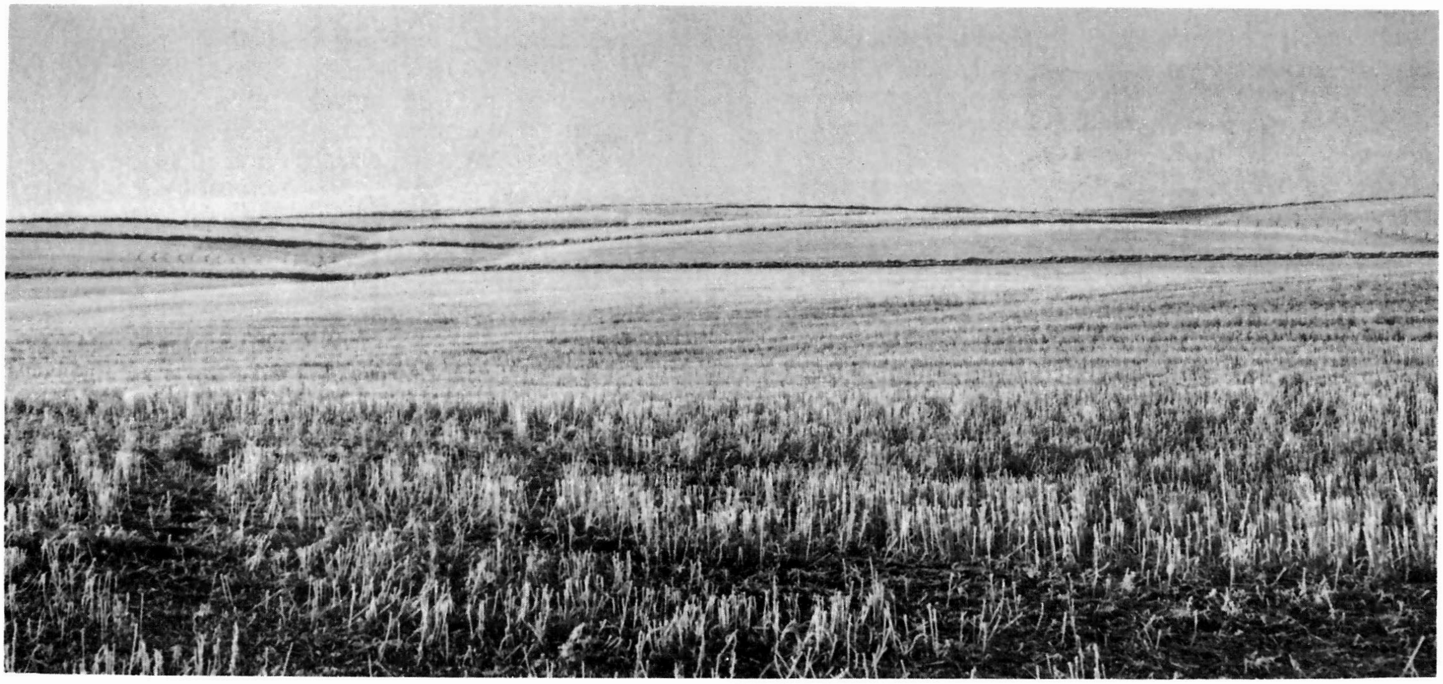


Figure 7.—Wheat stubble on Morrow silt loam, 1 to 7 percent slopes, in foreground. Beyond this is Morrow silt loam, 7 to 12 percent slopes In the background is an area of Morrow silt loam, 12 to 20 percent slopes, dissected by diversion terraces for the control of water erosion.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass. For dryland hay and pasture, suitable grasses and legumes grown alone or in combination are alfalfa, big bluegrass, crested wheatgrass, Siberian wheatgrass, intermediate wheatgrass, beardless wheatgrass, tall wheatgrass, and hard fescue (*3*).

The native plant community is dominated by bluebunch wheatgrass and Idaho fescue. Sandberg bluegrass is prominent. A variety of perennial forbs occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass and Idaho fescue decrease and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, cheatgrass, low value forbs, and shrubs predominate.

If the range is in poor condition, seedbed preparation and seeding are practical. Suitable for dryland seeding are big bluegrass, crested wheatgrass, beardless wheatgrass, and alfalfa.

Mule deer use the plant community in spring and fall when plants are green and succulent. The plant community also provides food for small mammals and game birds.

The depth to bedrock and moderately slow permeability are limitations for community developments and sanitary facilities. The heavy texture of the subsoil can cause shrinking and swelling. Design modifications are needed for successful use of this soil. Permeability is a limitation for recreation facilities.

The capability subclass is IIIe dryland.

31C—Morrow silt loam, 7 to 12 percent slopes. This is a moderately deep, well drained soil on uplands at elevations of 2,200 to 3,500 feet. It formed in wind laid silt. The average slope is 9 percent. The average annual precipitation is 12 to 14 inches, and the average annual air temperature is 46 to 50 degrees F. The frost free period is 110 to 140 days at 32 degrees and 150 to 190 days at 28 degrees.

In a representative profile the surface layer is very dark brown silt loam about 9 inches thick. The subsoil is dark brown silty clay loam that grades to heavy silt loam. It is about 10 inches thick. The substratum is dark brown silt loam about 7 inches thick. Fractured basalt is at a depth of about 26 inches.

About 15 percent of this unit is included areas of Lickskillet and Bakeoven soils.

Permeability is moderately slow. Effective rooting depth is restricted by the underlying bedrock at a depth of 20 to 40 inches. Available water holding capacity is 4 to 8.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is medium, and the hazard of erosion is moderate.

Most of the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. Other areas are used for range and wildlife habitat.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Cross-slope tillage, contour tillage, and diversions are generally needed to prevent severe erosion caused by rapid runoff during high intensity rainfall or snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass. For dryland hay and pasture, suitable grasses and legumes grown alone or in combination are alfalfa, big bluegrass, crested wheatgrass, Siberian wheatgrass, intermediate wheatgrass, beardless wheatgrass, tall wheatgrass, and hard fescue (*3*).

The native plant community is dominated by bluebunch wheatgrass and Idaho fescue. Sandberg bluegrass is prominent. A variety of perennial forbs occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass and Idaho fescue decrease and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, cheatgrass, low value forbs, and shrubs predominate.

If the range is in poor condition, seedbed preparation and seeding are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, beardless wheatgrass, and alfalfa.

Mule deer use this plant community in spring and again in fall when plants are green and succulent. The plant community also provides food for small mammals and game birds.

The depth to rock, slope, and moderately slow permeability are limitations for community developments and sanitary facilities. The heavy texture of the subsoil can also cause shrinking and swelling. Design modifications are needed for dwellings, small buildings, and sanitary facilities. The permeability and slope are limitations for recreation facilities.

The capability subclass is IIIe dryland.

32D—Morrow silt loam, 12 to 20 percent north slopes. This is a moderately deep, well drained soil on north-facing slopes on uplands at elevations of 2,200 to 3,500 feet. It formed in wind laid silt. The average slope is 15 percent. The average annual precipitation is 12 to 14 inches, and the average annual air temperature is 46 to 50 degrees F. The frost free period is 110 to 140 days at 32 degrees and 150 to 190 days at 28 degrees.

In a representative profile the surface layer is very dark brown silt loam about 9 inches thick. The subsoil is dark brown silty clay loam that grades to heavy silt loam. It is about 10 inches thick. The substratum is dark brown silt loam about 7 inches thick. Fractured basalt is at a depth of about 26 inches.

About 15 percent of this unit is included areas of soils similar to Morrow soils but more than 40 inches thick and 15 percent is Lickskillet and Bakeoven soils.

Permeability is moderately slow. Effective rooting depth is restricted by the underlying bedrock at a depth from 20 to 40 inches. Available water holding capacity is 4 to 8.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is medium, and the hazard of erosion is moderate.

About half the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. Other areas are used for range and wildlife habitat.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch and minimum tillage along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage and diversions help to prevent severe erosion caused by rapid runoff during high intensity rainfall and snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

For dryland hay and pasture, suitable grasses and legumes grown alone or in combination are alfalfa, big bluegrass, crested wheatgrass, Siberian wheatgrass, intermediate wheatgrass, beardless wheatgrass, tall wheatgrass, and hard fescue (*3*).

The native plant community is dominated by Idaho fescue. Bluebunch wheatgrass and Cusick bluegrass are prominent. Sandberg bluegrass and a variety of perennial forbs occur throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, the proportion of bluebunch wheatgrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, annual grasses and low value forbs, such as common teasel and bullthistle, predominate.

If the range is in poor condition, seedbed preparation and seeding the more gently sloping areas to grass are practical. Suitable for dryland seeding are intermediate wheatgrass, hard fescue, pubescent wheatgrass, and alfalfa.

Mule deer use this plant community in summer and late in fall because of the cooler temperature and proximity to cover. The plant community also provides food for small mammals and game birds.

The slope, depth to bedrock, and moderately slow permeability are limitations for community uses. Extensive design modifications are needed for dwellings, small buildings, sanitary facilities, and recreation facilities.

The capability sublass is IVe dryland.

32E—Morrow silt loam, 20 to 35 percent north slopes. This is a moderately deep, well drained soil on north-facing slopes on uplands at elevations of 2,200 to 3,500 feet. It formed in wind laid silt. The average slope is 30 percent. The average annual precipitation is 12 to 14 inches, and the average annual air temperature is 46 to 50 degrees F. The frost-free period is 110 to 140 days at 32 degrees and 150 to 190 days at 28 degrees.

In a representative profile the surface layer is very dark brown silt loam about 9 inches thick. The subsoil is dark brown silty clay loam that grades to heavy silt loam. It is about 10 inches thick. The substratum is dark brown silt loam about 7 inches thick. Fractured basalt is at a depth of about 26 inches.

About 20 percent of this unit is included areas of soils that are similar to Morrow soils but are more than 40 inches thick and 10 percent is Wrentham soils.

Permeability is moderately slow. Effective rooting depth is restricted by the underlying bedrock at a depth from 20 to 40 inches. Available water holding capacity is 4 to 8.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas are used for range and wildlife habitat. The rest is under a grain-fallow cropping system. Wheat and barley are grown.

The native plant community is dominated by Idaho fescue. Bluebunch wheatgrass and Cusick bluegrass are prominent. Sandberg bluegrass and a variety of perennial forbs occur throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, the proportion of Idaho fescue and Cusick bluegrass decreases and the proportion of bluebunch wheatgrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, annual grasses and low value forbs, such as common teasel and bullthistle, predominate.

If the range is in poor condition, seedbed preparation and seeding the more gently sloping areas to grass are practical. Suitable for dryland seeding are intermediate wheatgrass, hard fescue, pubescent wheatgrass, and alfalfa.

Mule deer use this plant community in summer and late in fall because of the cooler temperatures and proximity to cover. Game birds and small mammals also use the plant community.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture for plant growth.

Where this soil is dryfarmed, stubble mulch and minimum tillage along with a crop-fallow system are needed to minimize erosion loss and help to maintain soil moisture. Contour tillage and diversions help to prevent severe erosion caused by rapid runoff during high intensity rainfall and snowmelt.

The slope, depth to rock, and moderately slow permeability are limitations for community uses. Extensive and expensive design modifications are needed for dwellings, small buildings, and sanitary facilities. The slope is a limitation for recreation facilities.

The capability subclass is IVe dryland.

33D—Morrow silt loam, 12 to 20 percent south slopes. This is a moderately deep, well drained soil on south-facing slopes on uplands at elevations of 2,200 to 3,500 feet. It formed in wind laid silt. The average slope is 15 percent. The average annual precipitation is 12 to 14 inches, and the average annual air temperature is 46 to 50 degrees F. The frost free period is 110 to 140 days at 32 degrees and 150 to 190 days at 28 degrees.

In a representative profile the surface layer is very dark brown silt loam about 9 inches thick. The subsoil is dark brown silty clay loam that grades to heavy silt loam. It is about 10 inches thick. The substratum is dark brown silt loam about 7 inches thick. Fractured basalt is at a depth of about 26 inches.

About 15 percent of this unit is included areas of soils that are similar to Morrow soils but are more than 40 inches thick and 15 percent is Lickskillet and Bakeoven soils.

Permeability is moderately slow. Effective rooting depth is restricted by the underlying bedrock at a depth of 20 to 40 inches. Available water holding capacity is 4 to 8.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is medium to rapid, and the hazard of erosion is moderate.

About half the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Barley is commonly grown and some dryland hay. Other areas are used for range, dryland pasture, and wildlife habitat.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch and minimum tillage along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage and diversions help to prevent severe erosion caused by rapid runoff during high intensity rainfall and snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

For dryland hay, suitable grasses and legumes grown alone or in combination are alfalfa, big bluegrass, crested wheatgrass, Siberian wheatgrass, and intermediate wheatgrass (*3*).

The native vegetation is a plant community dominated by bluebunch wheatgrass. Idaho fescue and Sandberg bluegrass are prominent. A variety of perennial forbs, such as arrowleaf balsamroot, milkvetch, and yarrow, occurs throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, plant vigor is greatly reduced and the proportion of bluebunch wheatgrass and other desirable grasses decreases. If deterioration is severe, cheatgrass and other low value plants predominate and the hazard of erosion is high.

Seedbed preparation and seeding of the more gently sloping areas are practical if the range is in poor condition. Suitable for dryland seeding are beardless wheatgrass, big bluegrass, crested wheatgrass, and alfalfa.

This plant community is used by mule deer in winter and early in spring when other areas are snow covered. In most areas it also provides food for a variety of small mammals and game birds. Wildlife should be considered in management planning.

The slope, depth to rock, and moderately slow permeability are limitations for community uses. Extensive design modifications are needed for dwellings, small buildings, sanitary facilities, and recreation facilities.

The capability subclass is VIe dryland.

33E—Morrow silt loam, 20 to 30 percent south slopes. This is a moderately deep, well drained soil on south-facing slopes on uplands at elevations of 2,200 to 3,500 feet. It formed in wind laid silt. The average slope is 25 percent. The average annual precipitation is 12 to 14 inches, and the average annual air temperature is 46 to 50 degrees F The frost free period is 110 to 140 days at 32 degrees and 150 to 190 days at 28 degrees.

In a representative profile the surface layer is very dark brown silt loam about 9 inches thick. The subsoil is dark brown silty clay loam that grades to heavy silt loam. It is about 10 inches thick. The substratum is dark brown silt loam about 7 inches thick. Fractured basalt is at a depth of about 26 inches.

About 15 percent of this unit is included areas of soils that are similar to Morrow soils but are more than 40 inches thick and 15 percent is Lickskillet and Bakeoven soils.

Permeability is moderately slow. Effective rooting depth is restricted by the underlying bedrock at a depth of 20 to 40 inches. Available water holding capacity is 4 to 8.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas are used for range and wildlife habitat. The rest is under a grain-fallow cropping system. Wheat and barley are grown.

The native vegetation is a plant community dominated by bluebunch wheatgrass. Idaho fescue and Sandberg bluegrass are prominent. A variety of perennial forbs, such as arrowleaf balsamroot, milkvetch, and yarrow, occurs throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, plant vigor is greatly reduced and the proportion of bluebunch wheatgrass and other desirable grasses decreases. If deterioration is severe, cheatgrass and other low value plants predominate and the potential for erosion is high.

Seedbed preparation and seeding of the more gently sloping areas are practical if the range is in poor condition. Suitable for dryland seeding are beardless wheatgrass, big bluegrass, crested wheatgrass, and alfalfa.

This plant community is used by mule deer in winter and early in spring when other areas are snow covered. Wildlife values should be considered in management planning.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Where this soil is dryfarmed, stubble mulch and minimum tillage along with a crop-fallow system are needed to minimize erosion loss and help to maintain soil moisture. Contour tillage and diversions help to prevent severe erosion caused by rapid runoff during high intensity rainfall and snowmelt.

The slope, depth to rock, and moderately slow permeability are limitations for community uses. Extensive and expensive design modifications are needed for dwellings, small buildings, and sanitary facilities. The slope is a limitation for recreation facilities.

The capability subclass is VIe dryland.

34F—Nansene silt loam, 35 to 70 percent slopes. This is a deep, well drained soil formed in loess. It is on north-facing slopes at elevations of 800 to 1,900 feet. The average slope is 50 percent. The average annual precipitation is 12 to 13 inches, and the average annual air temperature is 48 to 52 degrees F. The frost free period is 140 to 170 days at 32 degrees and 170 to 200 days at 28 degrees.

In a representative profile the surface layer is very dark brown silt loam about 25 inches thick. The subsoil is dark brown silt loam about 13 inches thick. The substratum is dark brown silt loam about 7 inches thick. Fractured basalt is at a depth of about 45 inches.

About 20 percent of this unit is included areas of Ritzville, Rhea, and Wrentham soils and 5 percent is Lickskillet soils.

Permeability is moderate. Effective rooting depth is 40 to 60 inches. Available water capacity is 6.5 to 11.5 inches. Water supplying capacity is 8 to 12 inches. Runoff is rapid, and the hazard of erosion is high.

This soil is used for livestock grazing and wildlife habitat.

The native plant community on this soil is dominated by Idaho fescue. Bluebunch wheatgrass and Cusick bluegrass are prominent. Sandberg bluegrass and a wide variety of perennial forbs occur throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, the proportion of Idaho fescue and Cusick bluegrass decreases and the proportion of bluebunch wheatgrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, annual grasses and low value forbs are prominent.

Because slopes are steep, seedbed preparation and range seeding are not practical.

Mule deer use the plant community in summer and late in fall because of the cooler temperatures and proxmity to cover. The steep slopes are limitations for community and recreation uses. Extensive design modifications are needed for dwellings, small buildings, and sanitary and recreation facilities.

The capability subclass is VIIe.

35—Onyx silt loam. This is a very deep, well drained soil formed in alluvium from loess and volcanic ash. It is on alluvial bottom lands at elevations of 1,000 to 2,500 feet. The average slope is 1 percent. The average annual precipitation is 12 to 14 inches, and the average annual air temperature is 49 to 51 degrees F. The frost free period is 130 to 170 days at 32 degrees and 170 to 200 days at 28 degrees.

In a representative profile the surface layer is very dark brown silt loam about 26 inches thick. The next layer is very dark brown very fine sandy loam about 6 inches thick. The upper 7 inches of the substratum is very dark grayish brown very fine sandy loam. The lower part is very dark grayish brown gravelly very fine sandy loam that extends to a depth of 60 inches or more.

About 20 percent of this unit is included areas of Pedigo, Endersby, and Snow soils.

Permeability is moderate. Effective rooting depth is more than 60 inches. Available water capacity is 7.5 to 12.5 inches. Water supplying capacity is 8 to 13 inches. Runoff is slow, and the hazard of erosion is slight. The soil is subject to rare flooding.

Nearly all the acreage is used for dryfarmed and irrigated crops. Hay and pasture are the main crops grown. Some winter wheat is also grown. Some irregularly shaped areas are used for range.

The major needs in crop management are conserving soil moisture and stabilizing streambanks against cutting by water. The proper timing and rate of applying irrigation water are needed. Where water is available, irrigation is by sprinklers, most commonly wheelline or handline systems.

A suitable cropping system under irrigation is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Light, frequent applications of irrigation water are needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the rooting zone by the irrigation water.

In dryfarmed areas where wheat is grown, stubble mulch and minimum tillage along with a crop-fallow system help to minimize erosion and conserve soil moisture.

Streambanks can be stabilized by maintaining streamside vegetation, especially giant wildrye and such riparian shrubs as lilac or willow. Such vegetation also is important wildlife cover.

For dryland pasture and hay, suitable grasses and legumes grown alone or in various combinations are alfalfa, Siberian wheatgrass, crested wheatgrass, beardless wheatgrass, big bluegrass, intermediate wheatgrass, pubescent wheatgrass, and hard fescue (*3*).

Areas of this soil support populations of upland game birds, such as the ring-necked pheasant and valley quail. Mule deer and smaller mammals use this soil for food and cover.

This soil occurs on stream flood plains. It is subject to rare flooding, which results in limitations for many community developments. It has no serious limitations for most recreation facilities. Camp areas are severely limited as a result of the flood hazard.

The capability subclass is IIc dryland and class I irrigated.

36—Pedigo silt loam. This is a very deep, somewhat poorly drained soil formed in alluvium derived from loess and volcanic ash. It is on alluvial bottom lands at elevations of 1,000 to 2,500 feet. The average slope is 1 percent. The average annual precipitation is 11 to 14 inches, and the average annual air temperature is 49 to 51 degrees F. The frost free period is 130 to 150 days at 32 degrees and 180 to 200 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsoil is dark brown silt loam about 21 inches thick. The substratum is dark grayish brown, dark brown, and brown silt loam that extends to a depth of 66 inches or more.

About 15 percent of this unit is included areas of Onyx and Endersby soils.

Permeability is moderate. Effective rooting depth is more than 60 inches. Available water capacity is 10 to 11 inches. Water supplying capacity is 9 to 13 inches. Runoff is slow, and the hazard of erosion is slight. The soil is subject to rare flooding. A water table is at a depth of 2.5 to 5 feet in winter and spring.

Nearly all the acreage is used for dryfarmed and irrigated crops. Hay and pasture are the main crops. Some winter wheat is also grown. Some irregularly shaped areas are used for range.

The major needs in crop management are conserving soil moisture and stabilizing streambanks against cutting by water. The proper timing and rate of applying irrigation water are needed. Where water is available, irrigation is by sprinklers, most commonly wheelline or handline systems.

In irrigated areas a suitable cropping system is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Because this soil is somewhat poorly drained, light, frequent applications of irrigation water are needed. The rate of these applications should not cause ponding of water on the surface. In some areas subsurface drains are needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the rooting zone by the irrigation water.

In dryfarmed areas where wheat is grown, stubble mulch and minimum tillage along with a crop-fallow system help to minimize erosion and conserve soil moisture.

Streambanks can be stabilized by maintaining streamside vegetation, especially giant wildrye and such riparian shrubs as lilac and willow. Such vegetation also is important wildlife cover.

For dryland pasture and hay, suitable grasses and legumes grown alone or in various combinations are alfalfa, Siberian wheatgrass, crested wheatgrass, beardless wheatgrass, big bluegrass, intermediate wheatgrass, pubescent wheatgrass, and hard fescue (*3*)

Areas of this soil support populations of upland game birds, such as ring-necked pheasant and valley quail. Mule deer use areas of this soil and the adjacent south-facing slopes in winter. The soil also provides food and cover for an assortment of smaller mammals.

This soil occurs on stream flood plains and is subject to rare flooding. Because the soil is somewhat poorly drained, it is subject to periods of wetness. These conditions are limitations for community and recreation developments.

The capability subclass is IIw dryland and irrigated.

37A—Prosser silt loam, 0 to 2 percent slopes. This is a moderately deep, well drained soil on terraces at elevations of 300 to 600 feet. It formed in wind laid silt. The average slope is 1 percent. The average annual precipitation is 7 to 9 inches, and the average annual air temperature is 50 to 54 degrees F. The frost free period is 160 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsoil is dark brown silt loam about 25 inches thick. Fractured bedrock is at a depth of about 29 inches.

About 20 percent of this unit is included areas of Quinton, Taunton, and Koehler soils and 15 percent is Quincy soils, shallow soils, and Rock outcrop.

Permeability is moderate. Effective rooting depth is restricted by the underlying bedrock at a depth of 20 to 40 inches. Available water holding capacity is 4 to 8.5 inches. Water supplying capacity is 6.5 to 8 inches. Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.

Most areas of this soil are used for range and wildlife habitat. Some of the acreage is used for irrigated alfalfa hay and pasture.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical. Because the hazard of soil blowing is severe, seeding to grass presents special management problems. Direct drill seeding after a fire is advisable to restore production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant.

Livestock grazing should be limited mainly to winter.

The major concern in the management of this soil is the proper application of irrigation water. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

For hay and pasture, suitable grasses to be grown with alfalfa include orchardgrass, smooth bromegrass, tall fescue, and meadow foxtail (*3*).

Because of the moderately low infiltration rate and moderate depth to bedrock, application rates of water should be carefully determined to avoid overirrigation.

Only irrigated hay and pasture are grown on this soil. As agriculture in the northern part of the survey area continues to grow, many other irrigated crops, such as wheat, corn, and potatoes, will be grown on this soil.

This soil supports small populations of mule deer. Birds and small mammals are common.

The depth of bedrock is a limitation for community uses. Design modifications are needed for dwellings, small buildings, and sanitary facilities. This soil has no serious limitations for most recreation facilities, but the depth to rock may be a limitation for playgrounds.

The capability subclass is VIc dryland, IIs irrigated.

37B—Prosser silt loam, 2 to 7 percent slopes. This is a moderately deep, well drained soil on uplands at elevations of 300 to 600 feet. It formed in wind laid silt. The average slope is 5 percent. The average annual precipitation is 7 to 9 inches, and the average annual air temperature is 51 to 54 degrees F. The frost free period is 160 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsoil is dark brown silt loam about 25 inches thick. Fractured bedrock is at a depth of about 29 inches.

About 20 percent of this unit is included areas of Quinton, Taunton, and Koehler soils and 15 percent is Quincy soils, shallow soils, and Rock outcrop.

Permeability is moderate. Effective rooting depth is restricted by the underlying bedrock at a depth of 20 to 40 inches. Available water holding capacity is 4 to 8.5 inches. Water supplying capacity is 6.5 to 8 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

Most areas are used for range and wildlife habitat. Some are used for irrigated alfalfa hay and pasture.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical considerations. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant.

Livestock grazing should be limited mainly to winter.

The major concern in management is the proper application of irrigation water. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

For hay and pasture, suitable grasses to be grown with alfalfa include orchardgrass, smooth bromegrass, tall fescue, and meadow foxtail (*3*).

Because of the moderate permeability and moderate depth to bedrock, application rates of irrigation water should be carefully determined in order to avoid overirrigation. Some erosion caused by runoff of excess irrigation water is probable if the soil is overirrigated.

Only irrigated hay and pasture are grown on this soil. Most likely many other irrigated crops, such as wheat, corn, and potatoes, will be grown.

This soil supports small populations of mule deer. Birds and small mammals are common.

The depth to bedrock is a limitation for community uses. Design modifications are needed for dwellings, small buildings, and sanitary facilities. This soil has no serious limitations for recreation facilities, but playgrounds may require cutting and filling.

The capability subclass is VIc dryland, IIe irrigated.

38D—Prosser-Rock outcrop complex, 1 to 20 percent slopes. This map unit is adjacent to the Columbia River at elevations of 300 to 600 feet. It is about 60 percent Prosser soil, 20 percent Rock outcrop, 20 percent Quinton, Taunton, Koehler, and Quincy soils.

The average slope is about 5 percent. The average annual precipitation is 7 to 9 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 160 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile of Prosser soil, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsoil is dark brown silt loam about 25 inches thick. Fractured basalt bedrock is at a depth of about 29 inches.

Rock outcrop is basalt bedrock.

The Prosser soil has moderate permeability. Effective rooting depth is 20 to 40 inches. Available water capacity is 4 to 8.5 inches. Water supplying capacity is 6.5 to 8 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly as rangeland and wildlife habitat. Small areas are used for irrigated permanent pasture. In most areas, the pattern of the Rock outcrop precludes irrigation.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. Direct drill seeding after a fire is advisable to restore production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant.

Livestock grazing should be limited mainly to winter.

This unit supports small populations of mule deer. Birds and small mammals are common.

The depth to rock limits construction of septic tanks and sewage lagoons. Dwellings, commercial buildings, and streets and roads may require some modification because of the depth to rock. Slope is a limitation for most recreation facilities.

The capability subclass is VIs dryland.

39C—Quincy fine sand, 2 to 12 percent slopes. This is a very deep, excessively drained soil formed in mixed sand. It is on terraces at elevations of 250 to 700 feet. The average slope is 6 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 degrees to 54 degrees F. The frost free period is 160 to 200 days at 32 degrees.

In a representative profile the upper 30 inches is dark brown fine sand. Below this is dark brown and brown sand that extends to a depth of 60 inches or more.

About 15 percent of this unit is included areas of Burbank, Quinton, Royal, and Winchester soils and Dune land.

Permeability is rapid. Effective rooting depth is more than 60 inches. Available water capacity is 3 to 4 inches. Water supplying capacity is 2 to 3 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Extensive areas of this soil are used for irrigated crops, and many more areas are being converted to irrigated cropland. A large percentage of the acreage is used for range and wildlife habitat, particularly where the soil is within the Boardman Naval Reservation. Major irrigated crops include potatoes, wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the low available water capacity and the hazard of soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed control and disease problems are common.

Because of the coarse texture, low water supplying capacity, and high water consumption, light, frequent applications of fertilizer are desirable.

The hazard of soil blowing is one of the highest in the area because of the predominance of fine sand in the surface layer and frequent, high winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts, hummocks, and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures needed to control soil blowing include winter cover crops; timely irrigations, cultivations, and planting; minimum tillage; crosswind tillage; and planting of row crops perpendicular to the wind. Blowout areas require special treatments, such as disked-in straw mulching and seeding to suitable grasses. Windbreaks, doublecropping, and stripcropping are needed in places. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation system before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is dominated by needleandthread and Indian ricegrass. Antelope bitterbrush is common and is prominent in places. Perennial forbs, such as Columbia milkvetch and Carey balsamroot, are common. Other shrubs, such as big sagebrush and rabbitbrush, occur sporadically.

If range condition deteriorates, the proportion of Indian ricegrass decreases and the proportion of needleandthread and low value forbs increases. If deterioration is severe, cheatgrass invades and strongly dominates the stand. As a result, the hazard of soil blowing during the growing season is severe, and sand movement may be difficult to control.

If the range is in poor condition, total protection of the existing plant cover is practical. Seedbed preparation and seeding present special problems because of the hazard of soil blowing. Direct drill seeding to crested or Siberian wheatgrass is advisable after a fire.

Livestock grazing should be limited mainly to winter.

This soil supports small populations of mule deer. Birds and small mammals are common.

This soil generally is well suited to community uses. Because of seepage, some design modifications of sewage lagoons and sanitary landfills are required in places. Construction of dwellings, commercial buildings, and roads and streets is somewhat limited in the steeper areas. Recreation facilities are limited by the fine sand.

The capability subclass is VIIe dryland, IVs irrigated.

40C—Quincy loamy fine sand, 2 to 12 percent slopes. This is a deep, excessively drained soil formed in mixed sand. It is on terraces near the Columbia River at elevations of 250 to 700 feet. The average slope is 4 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 160 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark brown loamy fine sand about 6 inches thick. Below this is dark brown and brown loamy fine sand that extends to a depth of 60 inches or more.

About 15 percent of this unit is included areas of Burbank, Quinton, Ellum, Royal, Sagehill, and Winchester soils and Dune land.

Permeability is rapid. Effective rooting depth is more than 60 inches. Available water capacity is 4 to 5.5 inches. Water supplying capacity is 2 to 3 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Extensive areas are used for irrigated crops, and many more are being converted to irrigated cropland. Much of the acreage is used for range and wildlife habitat. Major irrigated crops include potatoes, annual wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the low available water capacity and the hazard of soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa. If wheat or potatoes are grown in consecutive years, serious disease control problems are common.

Because of the coarse texture, low water supplying capacity, and high water consumption, light, frequent applications of irrigation water are needed. Plant nutrients are readily leached from the rooting zone because of the rapid permeability. Split applications of fertilizer are desirable.

The hazard of soil blowing is high because of the loamy fine sand and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts, hummocks, and dunes in the fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures needed to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Blowout areas need special treatment, such as disked-in straw mulching and seeding to suitable grasses. Windbreaks, doublecropping and stripcropping are needed in places. Protection from soil blowing is critical when new rangeland is converted to irrigated cropland. Completely developing the irrigation system before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is dominated by needleandthread and Indian ricegrass. Antelope bitterbrush is common and is prominent in places. Perennial forbs, such as Columbia milkvetch and Carey balsamroot, are common. Other shrubs, such as big sagebrush and rabbitbrush, occur sporadically.

If range condition deteriorates, the proportion of Indian ricegrass decreases and the proportion of needleandthread and low value forbs increases. If deterioration is severe, cheatgrass invades and strongly dominates the stand. As a result, the hazard of soil blowing during the growing season is high, and sand movement may be difficult to control.

If the range is in poor condition, total protection of the existing plant cover is practical. Seedbed preparation and seeding present a special problem because of the hazard of soil blowing. Direct drill seeding to crested or Siberian wheatgrass is feasible after a fire.

Livestock grazing should be limited primarily to winter.

This soil supports small populations of mule deer. Birds and small mammals are common.

This soil generally is well suited to community and recreation uses. Because of seepage, some design modifications of sewage lagoons and sanitary landfills are required in places. Construction of dwellings, buildings, and roads and streets is somewhat limited in the steeper areas.

The capability subclass is IVs irrigated, VIIe dryland.

41B—Quinton loamy fine sand, 2 to 5 percent slopes. This is a moderately deep, excessively drained soil formed in mixed sand. It is on terraces at elevations of 250 to 700 feet. The average slope is 3 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark brown loamy fine sand about 7 inches thick. The substratum is 23 inches of dark brown loamy fine sand over 7 inches of dark brown gravelly loamy fine sand. Fractured basalt is at a depth of about 37 inches.

About 15 percent of this unit is included areas of Koehler, Quincy, and Royal soils and Dune land.

Permeability is rapid. Effective rooting depth is restricted by the underlying bedrock at a depth from 20 to 40 inches. Available water capacity is 2 to 4 inches. Water supplying capacity is 2 to 3 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

About 80 percent of the acreage is used for irrigated alfalfa hay and pasture. The soil also is suited to such crops as potatoes, corn, and wheat. The rest is used for range and wildlife habitat.

Major concerns in management are the proper application of irrigation water and the hazard of soil blowing. Irrigation methods include flooding, handlines, and wheellines. Care should be taken not to overirrigate. In several areas of this soil near Boardman Naval Reservation, overirrigation has resulted in a high water table.

The hazard of soil blowing is high because of the loamy fine sand surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and hummocks in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Practices needed to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; and minimum tillage. Blowout areas require special treatment, such as disked-in straw mulching and seeding to suitable grasses. Much of the acreage in rangeland may be converted to irrigated cropland. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation systems before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community on this soil is dominated by needleandthread and Indian ricegrass. Antelope bitterbrush is common and is prominent in places. Perennial forbs, such as Columbia milkvetch and Carey balsamroot, are common. Other shrubs, such as big sagebrush and rabbitbrush, occur sporadically.

If range condition deteriorates, the proportion of Indian ricegrass decreases and the proportion of needleandthread and low value forbs increases. If deterioration is severe, cheatgrass invades and strongly dominates the stand. As a result, the potential for soil blowing during the growing season is high, and sand movement may be difficult to control.

If the range is in poor condition, total protection of the existing plant cover is practical. Seedbed preparation and seeding present a special problem because of the hazard of soil blowing. Direct drill seeding of crested or Siberian wheatgrass is advisable after a fire.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The depth to rock and seepage are limitations for sanitary facilities. This soil is generally well suited to construction of dwellings, commercial buildings, and roads and streets. Dwellings with basements may require some variation in design because of the depth to rock. The soil has no serious limitation for recreation facilities. Playgrounds in steeper areas may require leveling.

The capability subclass is VIIe dryland, IVe irrigated.

42D—Quinton-Rock outcrop complex, 2 to 20 percent slopes. This map unit is adjacent to the Columbia River at elevations of 250 to 350 feet. It is about 60 percent Quinton soil, 20 percent Rock outcrop, and 20 percent Koehler and Quincy soils and Dune land.

The average slope is about 10 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile of Quinton soil, the surface layer is dark brown loamy fine sand about 7 inches thick. The substratum is 23 inches of dark brown loamy fine sand over 7 inches of dark brown gravelly loamy fine sand. Fractured basalt is at a depth of about 37 inches.

Rock outcrop is basalt bedrock.

The Quinton soil has rapid permeability. Effective rooting depth is 20 to 40 inches. Available water capacity is 2 to 4 inches. Water supplying capacity is 2 to 3 inches. Runoff is slow and the hazard of water erosion is slight. The hazard of soil blowing is high.

This unit is used mainly for rangeland and wildlife habitat. In most areas the pattern of the Rock outcrop precludes irrigation.

The native plant community is dominated by needleandthread and Indian ricegrass. Antelope bitterbrush is common and is prominent in places. Perennial forbs, such as Columbia milkvetch and Carey balsamroot, are common. Other shrubs, such as big sagebrush and rabbitbrush, occur in minor amounts.

If range condition deteriorates, the proportion of Indian ricegrass decreases and the proportion of needleandthread and low value forbs increases. If deterioration is severe, cheatgrass invades and strongly dominates the stand. As a result, the potential for soil blowing during the growing season is high and sand movement may be difficult to control.

If the range is in poor condition, total protection of the existing plant cover is a practical consideration. Seedbed preparation and seeding present a special problem because of the soil blowing hazard. Direct drill seeding of crested or Siberian wheatgrass is advisable after a fire.

Livestock grazing should be limited mainly to winter.

This unit supports small populations of mule deer. Waterfowl, other birds, and small mammals are common.

The depth to rock and seepage are limitations for sanitary facilities. Construction of dwellings, commercial buildings, roads and streets, and recreation facilities may require some variation in design because of the depth to rock and Rock outcrop.

The capability subclass is VIIe dryland.

43B—Rhea silt loam, 1 to 7 percent slopes. This is a very deep, well drained soil formed in material from wind laid silt mixed with small amounts of volcanic ash. It occurs at elevations of 1,600 to 3,200 feet. The average slope is 4 percent. The average annual precipitation is 11 to 14 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free period is 100 to 150 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the upper 7 inches of the surface layer is very dark brown silt loam, and the lower 7 inches is very dark grayish brown silt loam. The subsoil is dark brown and brown silt loam about 19 inches thick. The substratum is dark brown silt loam that extends to a depth of 60 inches or more (fig. 8).

About 20 percent of this unit is included areas of Valby soils and soils formed in volcanic ash and 5 percent is Bakeoven and Lickskillet soils.

Permeability is moderate. Effective rooting depth is more than 60 inches. Available water capacity is 8 to 15 inches. Water supplying capacity is 6 to 10 inches. Runoff is slow, and the hazard of erosion is slight.

Nearly all the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. The rest of the acreage is used for range and wildlife habitat.

The major need in crop management is conserving soil moisture.

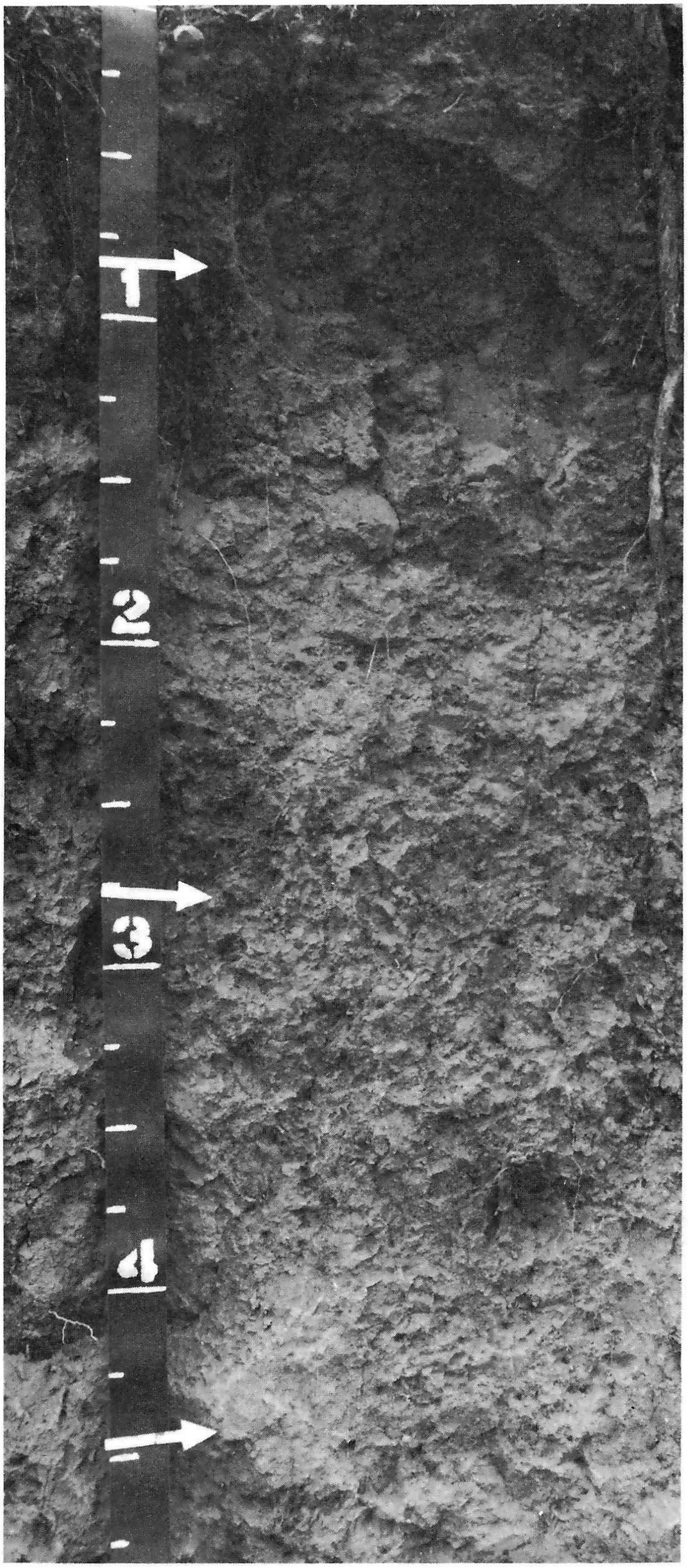


Figure 8.—Profile of Rhea silt loam Basalt is below 60 inches

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system help to maintain soil moisture. Cross-slope tillage in the more level areas and contour tillage and diversions in the steeper areas are desirable, especially where slopes are long.

Response of wheat and barley to nitrogen fertilizer is low as a result of low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass. For dryland hay, suitable grasses and legumes grown alone or in combination are alfalfa, big bluegrass, crested wheatgrass, Siberian wheatgrass, and intermediate wheatgrass (*3*).

The native plant community is dominated by bluebunch wheatgrass and Idaho fescue. Sandberg bluegrass is prominent. A variety of perennial forbs occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass and Idaho fescue decrease and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, cheatgrass, low value forbs, and shrubs predominate.

If the range is in poor condition, seedbed preparation and seeding are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, beardless wheatgrass, and alfalfa.

Mule deer use this plant community in spring and fall when plants are green and succulent. The plant community also provides food for small mammals and game birds.

This soil has no serious limitations for community uses or recreation facilities. Playgrounds may require leveling in the steeper areas.

The capability subclass is IIe dryland.

43C—Rhea silt loam, 7 to 12 percent slopes. This is a very deep, well drained soil formed in material from wind laid silt mixed with small amounts of volcanic ash. It occurs on uplands at elevations of 1,600 to 3,200 feet. The average slope is 9 percent. The average annual precipitation is 11 to 14 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free period is 100 to 150 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the upper 7 inches of the surface layer is very dark brown silt loam, and the lower 7 inches is very dark grayish brown silt loam. The subsoil is dark brown and brown silt loam about 19 inches thick. The substratum is dark brown silt loam that extends to a depth of 60 inches or more.

About 20 percent of this unit is included areas of Valby soils and soils formed in volcanic ash and 5 percent is Bakeoven soils.

Permeability is moderate. Effective rooting depth is more than 60 inches. Available water capacity is 8 to 15 inches. Water supplying capacity is 6 to 10 inches. Runoff is medium, and the hazard of erosion is moderate.

Most of the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. The rest of the acreage is used for range and wildlife habitat.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Cross-slope tillage, contour tillage, and diversions are generally needed to prevent severe erosion from rapid runoff during high intensity rainfall or snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass. For dryland hay, suitable grasses and legumes grown alone or in combination are alfalfa, big bluegrass, crested wheatgrass, Siberian wheatgrass, and intermediate wheatgrass (*3*).

The native plant community is dominated by bluebunch wheatgrass and Idaho fescue. Sandberg bluegrass is prominent. A variety of perennial forbs occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass and Idaho fescue decrease and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, cheatgrass, low value forbs, and shrubs predominate.

If the range is in poor condition, seedbed preparation and seeding are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, beardless wheatgrass, and alfalfa.

Mule deer use this plant community in spring and fall when plants are green and succulent. The plant community also provides food for small mammals and game birds.

The slope is a limitation for community and recreation uses. Design modifications are needed for dwellings, small buildings, and sanitary facilities to overcome slope. Playgrounds require major cutting and filling

The capability subclass is IIIe dryland.

43D—Rhea silt loam, 12 to 20 percent slopes. This is a very deep, well drained soil formed in material from wind laid silt mixed with small amounts of volcanic ash. It occurs at elevations of 1,600 to 3,200 feet. The average slope is 15 percent. The average annual precipitation is 11 to 14 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free period is 100 to 150 days at 32 degrees F. and 150 to 200 days at 28 degrees.

In a representative profile the upper 7 inches of the surface layer is very dark brown silt loam, and the lower 7 inches is very dark grayish brown silt loam. The subsoil is dark brown and brown silt loam about 19 inches thick. The substratum is dark brown silt loam that extends to a depth of 60 inches or more.

About 20 percent of this map unit is included areas of Valby soils and soils formed in volcanic ash and 5 percent is Bakeoven soils.

Permeability is moderate. Effective rooting depth is more than 60 inches. Available water capacity is 8 to 15 inches. Water supplying capacity is 6 to 10 inches. Runoff is medium, and the hazard of erosion is moderate.

About half the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. The rest of the acreage is used for range and wildlife habitat.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch and minimum tillage along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage and diversions help to prevent severe erosion from rapid runoff during high intensity rainfall and snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

For dryland hay, suitable grasses and legumes grown alone or in combination are alfalfa, big bluegrass, crested wheatgrass, Siberian wheatgrass, and intermediate wheatgrass (*3*).

The native plant community is dominated by bluebunch wheatgrass and Idaho fescue. On slopes facing strongly to the north, Idaho fescue may be dominant. Sandberg bluegrass and a variety of perennial forbs occur throughout the stand. Shrubs are minor

If range condition deteriorates, bluebunch wheatgrass and Idaho fescue decrease and the proportion of Sandberg bluegrass and perennial forbs increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, annual weeds, lupine, and low value shrubs predominate.

If the range is in poor condition, seedbed preparation and seeding of the more gently sloping areas to grass are practical. Suitable for dryland seeding are big bluegrass, crested wheatgrass, beardless wheatgrass, and alfalfa.

The plant community provides food for mule deer, small mammals and game birds.

The slope is a limitation for community and recreation uses. Extensive design modifications are needed for dwellings, small buildings, sanitary facilities, and most recreation facilities.

The capability subclass is IIIe dryland.

43E—Rhea silt loam, 20 to 35 percent slopes. This is a very deep, well drained soil formed in material from wind laid silt mixed with small amounts of volcanic ash. It occurs at elevations of 1,600 to 3,200 feet. The average slope is 28 percent. The average annual precipitation is 11 to 14 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free period is 100 to 150 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the upper 7 inches of the surface layer is very dark brown silt loam, and the lower 7 inches is very dark grayish brown silt loam. The subsoil is dark brown and brown silt loam about 19 inches thick. The substratum is dark brown silt loam that extends to a depth of 60 inches or more.

About 20 percent of this map unit is included areas of Valby soils and soils formed in volcanic ash and 5 percent is Lickskillet soils.

Permeability is moderate. Effective rooting depth is more than 60 inches. Available water capacity is 8 to 15 inches. Water supplying capacity is 6 to 10 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this soil are used for range and wildlife habitat. The rest is under a grain-fallow cropping system. Wheat and barley are grown.

The native plant community is dominated by bluebunch wheatgrass and Idaho fescue. On slopes facing strongly to the north, Idaho fescue may be dominant. Sandberg bluegrass and a variety of perennial forbs occur throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass and Idaho fescue decrease and the proportion of Sandberg bluegrass and perennial forbs increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, annual weeds, lupine, and low value shrubs predominate.

If the range is in poor condition, seedbed preparation and seeding of the more gently sloping areas to grass are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, beardless wheatgrass, and alfalfa.

The plant community provides food and cover for mule deer, small mammals, and game birds.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

In areas where this soil is dryfarmed, stubble mulch and minimum tillage along with a crop-fallow system are necessary to minimize erosion loss and help to maintain soil moisture. Contour tillage and diversions help to prevent severe erosion from rapid runoff during high intensity rainfall and snowmelt.

The slope is a severe limitation for community and recreation uses. Extensive design modifications are needed for dwellings, small buildings, sanitary facilities, and most recreation facilities.

The capability subclass is IVe dryland.

43F—Rhea silt loam, 35 to 50 percent slopes. This is a very deep, well drained soil formed in material from wind laid silt mixed with small amounts of volcanic ash. It occurs at elevations of 1,600 to 3,200 feet. The average slope is 40 percent. The average annual precipitation is 11 to 14 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free period is 100 to 150 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the upper 7 inches of the surface layer is very dark brown silt loam, and the lower 7 inches is very dark grayish brown silt loam. The subsoil is dark brown and brown silt loam about 19 inches thick. The substratum is dark brown silt loam that extends to a depth of 60 inches or more.

About 20 percent of this map unit is included areas of Valby soils and 5 percent is Lickskillet soils.

Permeability is moderate. Effective rooting depth is more than 60 inches. Available water capacity is 8 to 15 inches. Water supplying capacity is 6 to I0 inches. Runoff is rapid, and the hazard of erosion is high.

This soil is used for range and wildlife habitat.

The native plant community is dominated by bluebunch wheatgrass and Idaho fescue. On slopes facing strongly to the north, Idaho fescue may be dominant. Sandberg bluegrass and a variety of perennial forbs occur throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass and Idaho fescue decrease and the proportion of Sandberg bluegrass and perennial forbs increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, annual weeds, lupine, and low value shrubs predominate.

Because of the steep slopes, range seeding is not practical.

Most areas provide food and cover for mule deer, small mammals, and game birds.

The slope is a limitation for community and recreation uses. Extensive design modifications are needed but in most places are not practical for dwellings, small buildings, and sanitary facilities and most recreation facilities.

The capability subclass is VIe dryland.

44B—Ritzville very fine sandy loam, 2 to 7 percent slopes. This is a deep, well drained soil formed in wind laid silt and volcanic ash. It occurs at elevations of 1,000 to 2,500 feet. The average slope is 4 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown very fine sandy loam about 13 inches thick. The subsoil is dark brown and brown silt loam about 20 inches thick. The substratum is brown silt loam that extends to a depth of 60 inches or more.

About 15 percent of this unit is included areas of Warden and Willis soils, 10 percent is Sagehill soils, and 5 percent is Gravden soils.

Permeability is moderate. Effective rooting depth is more than 60 inches. Available water capacity is 7 to 12.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is slow, and the erosion hazard is slight. The hazard of soil blowing is moderate.

Nearly all the acreage is used for crops under a grain-fallow system. Some areas are irrigated. Winter wheat is the main crop. Some hay is also grown. A few areas are used for range and wildlife habitat.

The major needs in crop management are protecting the soil from soil blowing and conserving soil moisture. The proper timing and rate of applying irrigation water are needed. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system under irrigation is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Because of the high water consumption, light, frequent applications of irrigation water are needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the rooting zone by the irrigation water. Irrigation rates need to be monitored. If they exceed the infiltration rate of the soil, runoff and erosion losses result.

The soil blowing hazard can be a limitation because of the very fine sandy loam texture and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts, hummocks, and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. In irrigated areas practices that may be needed to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; and minimum tillage. Blowout areas require special treatment such as disked-in straw mulching and seeding to suitable grasses. Doublecropping and stripcropping are needed in places. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation system before any land is broken out and leaving vegetation intact on odd areas are the practices and precautions needed.

Stubble mulch, minimum tillage, and grassed waterways along with a grain-fallow system reduce water erosion and help to maintain soil moisture in dryfarmed cropland. Cross-slope tillage in the more level areas and diversions in the steeper areas are desirable, particularly where slopes are long.

Response of wheat and barley to nitrogen fertilizer is low because of the low annual rainfall. Generally, 25 pounds per acre of nitrogen fertilizer is applied to summer fallow in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass.

The native plant community is dominated by bluebunch wheatgrass and Sandberg bluegrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is left bare.

If the range is in poor condition, seedbed preparation and seeding are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

This soil has no serious limitations for community developments. It has no serious limitations for recreation facilities, but playgrounds require leveling because of the slopes.

The capability subclass is IIIe dryland, IIe irrigated.

44C—Ritzville very fine sandy loam, 7 to 12 percent slopes. This is a deep, well drained soil formed in wind laid silt and volcanic ash. It occurs at elevations of 1,000 to 2,500 feet. The average slope is 9 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown very fine sandy loam about 13 inches thick. The subsoil is dark brown and brown silt loam about 20 inches thick. The substratum is brown silt loam that extends to a depth of 60 inches or more.

About 15 percent of this unit is included areas of Warden and Willis soils, 10 percent is Sagehill soils, and 5 percent is Gravden soils.

Permeability is moderate. Effective rooting depth is more than 60 inches. Available water capacity is 7 to 12.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is medium, and the hazard of erosion is moderate. The hazard of soil blowing is moderate.

Nearly all the acreage is used for crops under a grain-fallow system. Some areas are irrigated. Winter wheat is the main crop. Some hay is also grown. The rest of the acreage is used for range and wildlife habitat.

The major needs in crop management are protecting the soil from blowing and water erosion and conserving soil moisture. The proper timing and rate of applying irrigation water are needed. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system under irrigation is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Because of the high water consumption, light, frequent applications of irrigation water are needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the root zone by the irrigation water. The rate at which irrigation water is applied is important. If it exceeds the infiltration rate of the soil, runoff and erosion losses result.

The soil blowing hazard can be a limitation because of very fine sandy loam texture and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts, hummocks, and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures needed in irrigated areas to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; and minimum tillage. Blowout areas require special treatment, such as disked-in straw mulching and seeding to suitable grasses. Doublecropping and stripcropping are needed in places. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation system before any land is broken out and leaving vegetation intact on odd areas are the practices and precautions needed.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system minimize erosion loss and help to maintain soil moisture in dryfarmed cropland. Cross-slope tillage, contour tillage, and diversions generally are needed to prevent erosion during high intensity rainfall and snowmelt.

Response of wheat and barley to nitrogen fertilizer is low because of the low annual rainfall. Generally, 25 pounds per acre of nitrogen fertilizer is applied to summer fallow in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass.

The native plant community is dominated by bluebunch wheatgrass and Sandberg bluegrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is left bare.

If the range is in poor condition, seedbed preparation and seeding are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

The slope is a limitation for community and recreation uses. Modifications in design are needed for dwellings, sanitary facilities, and most recreation facilities.

The capability subclass is IIIe dryland, IIIe irrigated.

44D—Ritzville very fine sandy loam, 12 to 25 percent slopes. This is a deep, well drained soil formed in wind laid silt and volcanic ash. It occurs at elevations of 1,000 to 2,500 feet. The average slope is 17 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown very fine sandy loam about 13 inches thick. The subsoil is dark brown and brown silt loam about 20 inches thick. The substratum is brown silt loam that extends to a depth of 60 inches or more.

About 15 percent of this unit is included areas of Warden and Willis soils, 10 percent is Sagehill soils, and 5 percent is Gravden gravelly loam.

Permeability is moderate. Effective rooting depth is more than 60 inches. Available water capacity is 7 to 12.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is medium to rapid, and the hazard of erosion is moderate. The hazard of soil blowing is medium.

About half the acreage is used for crops under a grain-fallow system. Some areas, mainly small areas of this soil in areas of gently sloping Ritzville soils, are irrigated. Winter wheat is the main crop. Some hay is grown. The rest of the acreage is used for range and wildlife habitat.

The major needs in crop management are protecting the soil from soil blowing and water erosion and conserving soil moisture. The proper timing and rate of applying irrigation water are needed. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system under irrigation is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Because of the high water consumption and the slope, light, frequent applications of irrigation water are needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the root zone by the irrigation water. In sloping areas the rate at which irrigation water is applied is important. If it exceeds the infiltration rate of the soil, runoff and possible serious erosion losses result.

The soil blowing hazard can be a limitation because of the very fine sandy loam texture and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts, hummocks, and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. In irrigated areas measures that may be needed to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; and minimum tillage. Blowout areas require special treatments, such as disked-in straw mulching and seeding to suitable grasses. Doublecropping and stripcropping are needed in places. Protection from soil blowing is critical when new rangeland is converted to irrigated cropland. Completely developing the irrigation system before any land is broken out and leaving vegetation intact on odd areas are the practices and precautions needed.

Stubble mulch and minimum tillage along with a crop-fallow system both minimize erosion loss and help to maintain soil moisture in dryfarmed cropland. Contour tillage and diversions help to prevent severe erosion during high intensity rainfall and snowmelt.

Response of wheat and barley to nitrogen fertilizer is low because of the low annual rainfall. Generally, 25 pounds per acre of nitrogen fertilizer is applied to summer fallow in spring or fall.

The native plant community is dominated by bluebunch wheatgrass and Sandberg bluegrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is left bare.

If the range is in poor condition, seedbed preparation and seeding are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

The slope is a limitation for community and recreation uses. Extensive modifications in design are needed for dwellings, sanitary facilities, and most recreation facilities.

The capability subclass is IVe dryland, IIIe irrigated.

45A—Ritzville silt loam, 0 to 2 percent slopes. This is a deep, well drained soil formed in wind laid silt and volcanic ash. It occurs at elevations of 1,000 to 2,500 feet. The average slope is 1 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 13 inches thick. The subsoil is dark brown and brown silt loam about 20 inches thick. The substratum is brown silt loam that extends to a depth of 60 inches or more.

About 25 percent of this unit is included areas of Mikkalo silt loam and Warden and Willis soils and 5 percent is Gravden and Bakeoven soils.

Permeability is moderate. Effective rooting depth is 40 to 60 inches. Available water capacity is 7 to 12.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is slow, and the hazard of erosion is slight.

Nearly all the acreage is used for crops under a grain-fallow system. Some areas are irrigated. Winter wheat is the main crop. Some hay is also grown. The rest of the acreage is used for range and wildlife habitat.

The major needs in crop management are protecting the soil from water erosion and conserving soil moisture. The proper timing and rate of applying irrigation water are needed. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system under irrigation is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Because of the high water consumption, light, frequent applications of irrigation water are needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the root zone by the irrigation water. The rate at which irrigation water is applied is important. If it exceeds the infiltration rate of the soil, runoff and erosion losses result.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system minimize erosion loss and help to maintain soil moisture in dryfarmed cropland.

Response of wheat and barley to nitrogen fertilizer is low because of the low annual rainfall. Generally, 25 pounds per acre of nitrogen fertilizer is applied to summer fallow in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass.

The native plant community is dominated by bluebunch wheatgrass and Sandberg bluegrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is left bare.

If the range is in poor condition, seedbed preparation and seeding are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

This soil has no serious limitations for community developments.

The capability subclass is IIIc dryland and class I irrigated.

45B—Ritzville silt loam, 2 to 7 percent slopes. This is a deep, well drained soil formed in wind laid silt and volcanic ash. It occurs at elevations of 1,000 to 2,500 feet. The average slope is 4 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 13 inches thick. The subsoil is dark brown and brown silt loam about 20 inches thick. The substratum is brown silt loam that extends to a depth of 60 inches or more.

About 20 percent of this unit is included areas of Mikkalo silt loam, Warden silt loam, and Willis silt loam; 2 percent is Gravden gravelly loam; and 1 percent is volcanic ash deposits.

Permeability is moderate. Effective rooting depth is more than 60 inches. Available water capacity is 7 to 12.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is slow, and the hazard of erosion is slight.

Nearly all the acreage is used for crops under a grain-fallow system. Some areas are irrigated. Winter wheat is the main crop. Some hay is also grown. The rest of the acreage is used for range and wildlife habitat.

The major need in crop management is conserving soil moisture. The proper timing and rate of applying irrigation water are needed. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system under irrigation is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Because of the high water consumption, light, frequent applications of irrigation water are needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the root zone by the irrigation water. The rate at which irrigation water is applied is important. If it exceeds the infiltration rate of the soil, runoff and erosion losses result.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system help to maintain soil moisture in dryfarmed cropland. Cross-slope tillage in the more level areas and diversions in the steeper areas are desirable, especially where slopes are long.

Response of wheat and barley to nitrogen fertilizer is low because of the low annual rainfall. Generally, 25 pounds per acre of nitrogen fertilizer is applied to summer fallow in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass.

The native plant community is dominated by bluebunch wheatgrass and Sandberg bluegrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is left bare.

If the range is in poor condition, seedbed preparation and seeding are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

This soil has no serious limitations for community developments. It has no serious limitations for recreation facilities, but playgrounds require leveling because of the slope.

The capability subclass is IIIe dryland, IIe irrigated.

45C—Ritzville silt loam, 7 to 12 percent slopes. This is a deep, well drained soil formed in wind laid silt and volcanic ash. It occurs at elevations of 1,000 to 2,500 feet. The average slope is 9 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 13 inches thick. The subsoil is dark brown and brown silt loam about 20 inches thick. The substratum is brown silt loam that extends to a depth of 60 inches or more.

About 25 percent of this unit is included areas of Mikkalo, Warden, and Willis soils and 5 percent is Gravden, Bakeoven, and Lickskillet soils.

Permeability is moderate. Effective rooting depth is 40 to 60 inches. Available water capacity is 7 to 12.5

inches. Water supplying capacity is 5 to 9 inches. Runoff is medium, and the hazard of erosion is moderate.

Most of the acreage is used for crops under a grain-fallow system. Some areas are irrigated. Winter wheat is the main crop. Some hay is also grown. The rest of the acreage is used for range and wildlife habitat.

The major needs in crop management are protecting the soil from water erosion and conserving soil moisture. The proper timing and rates of applying irrigation water are needed. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system under irrigation is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Because of the high water consumption, light, frequent applications of irrigation water are needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the rooting zone by the irrigation water. Irrigation rates must be monitored on slopes. If they exceed the infiltration rate of the soil, runoff and possibly serious erosion losses result.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system minimize erosion loss and help to maintain soil moisture in dryfarmed cropland. Cross-slope tillage, contour tillage, and diversions generally are needed to prevent erosion during high intensity rainfall and snowmelt.

Response of wheat and barley to nitrogen fertilizer is low because of the low annual rainfall. Generally, 25 pounds per acre of nitrogen fertilizer is applied to summer fallow in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass.

The native plant community is dominated by bluebunch wheatgrass and Sandberg bluegrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is left bare.

If the range is in poor condition, seedbed preparation and seeding are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

The slope is a limitation for community uses. Modifications in design are needed for dwellings and sanitary facilities. The slope is also a limitation for most recreation facilities.

The capability subclass is IIIe dryland and irrigated.

45D—Ritzville silt loam, 12 to 20 percent slopes. This is a deep, well drained soil formed in wind laid silt and volcanic ash. It occurs at elevations of 1,000 to 2,500 feet. The average slope is 15 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 13 inches thick. The subsoil is dark brown and brown silt loam about 20 inches thick. The substratum is brown silt loam that extends to a depth of 60 inches or more.

About 25 percent of this unit is included areas of Mikkalo, Warden, and Willis soils and 5 percent is Gravden, Bakeoven, and Lickskillet soils.

Permeability is moderate. Effective rooting depth is 40 to 60 inches. Available water capacity is 7 to 12.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is medium, and the hazard of erosion is moderate.

About half the acreage is used to raise crops under a grain-fallow system. Some areas, mainly small areas of gently sloping Ritzville soils, are irrigated. Winter wheat is the main crop. Some hay is grown. The rest of the acreage is used for range and wildlife habitat.

The major needs in crop management are protecting the soil from water erosion and conserving soil moisture. The proper timing and rate of applying irrigation water are needed. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system under irrigation is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Because of the high water consumption and the slope, light, frequent applications of irrigation water are needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the rooting zone by the irrigation water. Irrigation rates must be monitored on slopes. If they exceed the infiltration rate of the soil, runoff and possible serious erosion losses result.

Stubble mulch and minimum tillage along with a crop-fallow system minimize erosion loss and help to maintain soil moisture in dryfarmed cropland. Contour tillage and diversions help to prevent severe erosion during high intensity rainfall and snowmelt.

Response of wheat and barley to nitrogen fertilizer is low because of the low annual rainfall. Generally, 25 pounds per acre of nitrogen fertilizer is applied to summer fallow in spring or fall.

The native plant community is dominated by bluebunch wheatgrass and Sandberg wheatgrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is left bare.

If the range is in poor condition, seedbed preparation and seeding are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

The slope is a limitation for community and recreation uses. Extensive modifications in design are needed for dwellings, sanitary facilities, and most recreation facilities.

The capability subclass is IIIe dryland, IIIe irrigated.

46E—Ritzville silt loam, 20 to 40 percent north slopes. This is a deep, well drained soil formed in wind laid silt and volcanic ash. It is on north-facing slopes at elevations of 1,000 to 2,500 feet. The average slope is 30 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 13 inches thick. The subsoil is dark brown and brown silt loam about 20 inches thick. The substratum is brown silt loam that extends to a depth of 60 inches or more.

About 20 percent of this unit is included areas of Mikkalo, Warden, and Willis soils and 5 percent is Nansene soils.

Permeability is moderate. Effective rooting depth is 40 to 60 inches. Available water capacity is 7 to 12.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas are used for range and wildlife habitat. The others are under a grain-fallow system. Wheat and barley are grown.

The native plant community is dominated by bluebunch wheatgrass and Idaho fescue. On slopes facing strongly to the north, Idaho fescue may be dominant. Sandberg bluegrass and a variety of perennial forbs occur throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass and Idaho fescue decrease and the proportion of Sandberg bluegrass and perennial forbs increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, annual weeds, lupine, and low value shrubs predominate.

If the range is in poor condition, seedbed preparation and seeding of the more gently sloping areas to grass are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, beardless wheatgrass, and alfalfa.

The plant community and most areas of this soil provide food and cover for mule deer, small mammals, and game birds.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch and minimum tillage along with a crop-fallow system are necessary to minimize erosion loss and help to maintain soil moisture in dryfarmed cropland. Contour tillage and diversions help to prevent severe erosion from rapid runoff during high intensity rainfall and snowmelt.

The slope is a limitation for community and recreation uses. Extensive and expensive design modifications are needed for dwellings, small buildings, sanitary facilities, and recreation facilities.

The capability subclass is IVe dryland.

47E—Ritzville silt loam, 20 to 40 percent south slopes. This is a deep, well drained soil formed in wind laid silt and volcanic ash. It is on south-facing slopes at elevations of 1,000 to 2,500 feet. The average slope is 30 percent. The average annual precipitation is 9 to 12 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 130 to 180 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 13 inches thick. The subsoil is dark brown and brown silt loam about 20 inches thick. The substratum is brown silt loam that extends to a depth of 60 inches or more.

About 25 percent of this unit is included areas of Mikkalo and Warden soils and 15 percent is Gravden and Lickskillet soils.

Permeability is moderate. Effective rooting depth is 40 to 60 inches. Available water capacity is 7 to 12.5 inches. Water supplying capacity is 5 to 9 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas are used for range and wildlife habitat. The others are under a grain-fallow cropping system. Wheat and barley are grown.

The native plant community is dominated by bluebunch wheatgrass. Sandberg bluegrass and Thurber needlegrass are prominent. A variety of perennial forbs occurs throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and Thurber needlegrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, much of the surface is left bare and the hazard of soil erosion is high.

If the range is in poor condition, seedbed preparation and seeding of the more gently sloping areas to grass are practical considerations. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch and minimum tillage along with a crop-fallow system are needed to minimize erosion loss and help to maintain soil moisture in dryfarmed cropland. Contour tillage and diversions help to prevent severe erosion from rapid runoff during high intensity rainfall and snowmelt.

The slope is a limitation for community and recreation uses. Extensive and expensive design modifications are needed for dwellings, small buildings, sanitary facilities, and recreation facilities.

The capability subclass is IVe dryland.

48—Riverwash. This map unit consists of irregularly shaped strips of well rounded sand, gravel, stones, and boulders, generally of basalt. The strips are 40 to 200 yards wide. They are about 2 to 10 feet above the normal waterline in bends of stream channels and along drainageways. The slope is 0 to 5 percent. Depth to bedrock is 20 to more than 60 inches. The elevation ranges from about 850 to 3,100 feet. The average annual precipitation is 9 to 20 inches, and the average annual air temperature is 43 to 52 degrees F. The average frost free period is variable.

About 5 percent of this unit is Snow soils and Xeric Torriorthents.

Permeability is rapid to very rapid. Available water capacity and water supplying capacity vary. Effective rooting depth is 20 to 60 inches. The hazard of water erosion is high.

Riverwash is subject to overflow when the water is high, and it is extremely droughty when the water is low. During each overflow, material is deposited or removed. Small stones are a limitation. For these reasons, this unit has severe limitations for community and recreation developments. Some forage is produced, but generally this land has little value as range. Riverwash is used as wildlife habitat and as a possible source of gravel.

The capability subclass is VIIIs.

49F—Rock outcrop-Rubble land complex, very steep. This map unit is 65 to 75 percent Rock outcrop; 20 to 30 percent Rubble land; 10 percent Lickskillet, Bakeoven, Waterbury, and Rockly soils; and 5 percent Prosser, Quinton, Wrentham, and Klicker soils. It formed on uplands in basalt outcrop and rubble. It is bare basalt outcrop or cobbly and stony rubble that varies in thickness. The slope ranges from 5 percent to more than 100 percent. Elevations are 300 to 5,000 feet. The average annual precipitation is 7 to 25 inches, and the average annual air temperature is 45 to 54 degrees F. The frost free period is 50 to 180 days at 32 degrees and 100 to 215 days at 28 degrees.

Permeability is very slow in Rock outcrop and very rapid in Rubble land. Runoff is very rapid on Rock outcrop and very slow on Rubble land. Available water capacity and water supplying capacity are less than 0.5 inches. The hazard of erosion is slight.

The slope, depth to rock, and large stones are severe limitations for all community and recreation facilities. Except for small areas of included soils, this map unit has no value as range. In many places it forms a natural barrier to livestock. It is used mainly as wildlife habitat.

The capability subclass is VIIIs.

50D—Rockly very gravelly loam, 2 to 20 percent slopes. This is a very shallow, well drained soil formed in wind laid silt, volcanic ash, and basalt colluvium. It occurs at elevations of 3,000 to 4,300 feet. The average slope is 5 percent. The average annual precipitation is 14 to 22 inches, and the average annual air temperature is 47 to 49 degrees F. The frost free period is 60 to 120 days at 32 degrees and 120 to 170 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown very gravelly loam about 2 inches thick. It is 50 percent rock fragments. The subsoil is very dark grayish brown and dark brown very gravelly loam about 7 inches thick. It is 55 percent rock fragments up to 3 inches in size and about 5 percent fragments 3 inches or larger. Fractured basalt is at a depth of about 9 inches.

About 15 percent of this unit is included areas of Waha and Hankins soils.

Permeability is moderately slow. Effective rooting depth is restricted by the underlying bedrock at a depth of 5 to 12 inches. Available water capacity is 0.5 to 1.5 inches. Water supplying capacity is 1 to 4 inches. Runoff is slow to medium, and the hazard of erosion is moderate.

Nearly all areas of this soil are used for livestock grazing.

The major concern is maintaining an adequate plant cover for control of water erosion.

The native plant community is dominated by very shallow rooted plants, such as Sandberg bluegrass and Oregon bluegrass. Idaho fescue and bluebunch wheatgrass may also occur in small amounts. Low growing perennial forbs, such as pussytoes and phlox, are common.

If range condition deteriorates, small bluegrasses decrease and the proportion of low value forbs increases. If deterioration is severe, most plants are nearly eliminated and a barren rock pavement forms.

Because the soil is very shallow and stony, seedbed preparation and seeding are not practical.

This plant community is used by mule deer in winter and early in spring as a source of green succulent feed when other areas are snow covered. Areas of this soil provide limited food and cover for small mammals and game birds and song birds.

The depth to bedrock and stoniness are severe limitations for community and recreation uses. Extensive design modifications are needed but in most places are not practical for dwellings, small buildings, and sanitary and recreation facilities

The capability subclass is VIIs.

51B—Royal loamy fine sand, 2 to 5 percent slopes. This is a very deep, well drained soil formed in wind laid material. The elevation is 300 to 800 feet. The average slope is 3 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 150 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown loamy fine sand about 6 inches thick. The subsoil is dark brown fine sandy loam about 8 inches thick. The substratum is dark brown, dark grayish brown, and very dark gray stratified fine sandy loam, loamy fine sand, and fine sand that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Quincy and Burbank soils and 5 percent is Ellum, Sagehill, and Irrigon soils.

Permeability is moderately rapid. Effective rooting depth is 40 to 60 inches. Available water capacity is 5 to 9 inches. Water supplying capacity is 2 to 3 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. A large part of the acreage is used for range and wildlife habitat. Major irrigated crops include potatoes, wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the moderately low water capacity and the hazard of soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the moderately low water capacity and high water consumption, light, frequent applications of irrigation water are needed. Plant nutrients are readily leached from the rooting zone because of the moderately rapid permeability. Split applications of fertilizer are desirable.

The hazard of soil blowing is high because of the loamy fine sand texture of the surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and hummocks in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures needed to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Blowout areas require special treatment, such as disked-in straw mulching and seeding to suitable grasses. Doublecropping and stripcropping are needed in places. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation systems before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally dominates. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical considerations. Because the hazard of soil blowing is high, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil generally is well suited to community uses. Sanitary facilities, such as sewage lagoons and sanitary landfills, may require some modifications because of seepage. Some variation in design is needed for roads, dwellings, and commercial buildings because of the low strength. The loamy fine sand texture is a limitation for all types of recreation facilities unless the design is modified.

The capability subclass is VIe dryland, IIIe irrigated.

51C—Royal loamy fine sand, 5 to 12 percent slopes. This is a very deep, well drained soil formed in wind laid material. It occurs at elevations of 300 to 800 feet. The average slope is 8 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 150 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown loamy fine sand about 6 inches thick. The subsoil is dark brown fine sandy loam about 8 inches thick. The substratum is dark brown, dark grayish brown, and very dark gray stratified fine sandy loam, loamy fine sand, and fine sand that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Quincy and Burbank soils and 5 percent is Ellum, Sagehill, and Irrigon soils.

Permeability is moderately rapid. Effective rooting depth is 40 to 60 inches. Available water capacity is 5 to 9 inches. Water supplying capacity is 2 to 3 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. A large part of the acreage is used for range and wildlife habitat Major irrigated crops include potatoes, wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the moderately low water capacity and the hazard of soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the moderately low water capacity and high water consumption, light, frequent applications of irrigation water are needed. Plant nutrients are readily leached from the rooting zone because of the moderately rapid permeability. Split applications of fertilizer are desirable.

The hazard of soil blowing is high because of the loamy fine sand texture of the surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and hummocks in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures needed to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Blowout areas require special treatments, such as disked-in straw mulching and seeding to suitable grasses. Doublecropping and stripcropping are needed in places. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation systems before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally dominates. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical. Because the hazard of soil blowing is high, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil generally is well suited to community uses. Sanitary facilities, such as sewage lagoons and sanitary landfills, may require some modifications because of seepage. Some variation in design is needed for roads, dwellings, and commercial buildings because of the low strength. The loamy fine sand texture and slope are limitations for all recreation facilities unless the design is modified.

The capability subclass is VIe dryland, IIIe irrigated.

52B—Royal fine sandy loam, 2 to 5 percent slopes. This is a very deep, well drained soil formed in wind laid material. It occurs at elevations of 300 to 800 feet. The average slope is 3 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 150 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark brown fine sandy loam about 6 inches thick. The subsoil is dark brown very fine sandy loam about 11 inches thick. The substratum is dark brown, dark grayish brown, and very dark gray stratified fine sandy loam, loamy fine sand, and fine sand that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Quincy and Burbank soils and 5 percent is Ellum, Sagehill, and Irrigon soils.

Permeability is moderately rapid. Effective rooting depth is 40 to 60 inches. Available water capacity is 5 to 9 inches. Water supplying capacity is 2 to 3 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. A large percentage of the acreage is used as range and wildlife habitat. Major irrigated crops include potatoes, wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the moderately low water capacity and the hazard of soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the moderately low water capacity and high water consumption, light, frequent applications of irrigation water are needed. Plant nutrients are readily leached from the root zone because of the moderately rapid permeability. Split applications of fertilizer are desirable.

The hazard of soil blowing is high because of the fine sandy loam surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts, hummocks, and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help in controlling soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation systems before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is a good stand of needleandthread. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical. Because the hazard of soil blowing is high, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil generally is well suited to community uses. Sanitary facilities, such as sewage lagoons and sanitary landfills, may require some modifications because of seepage. The fine sandy loam texture is a limitation for all recreation facilities unless the design is modified.

The capability subclass is VIe dryland and IIe irrigated.

52C—Royal fine sandy loam, 5 to 12 percent slopes. This is a very deep, well drained soil formed in wind laid material. It occurs at elevations of 300 to 800 feet. The average slope is 8 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 150 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark brown fine sandy loam about 6 inches thick. The subsoil is dark brown very fine sandy loam about 11 inches thick. The substratum is dark brown, dark grayish brown and very dark gray stratified fine sandy loam, loamy fine sand, and fine sand that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Quincy and Burbank soils and 5 percent is Ellum, Sagehill, Irrigon, and Warden soils.

Permeability is moderately rapid. Effective rooting depth is 40 to 60 inches. Available water capacity is 5 to 9 inches. Water supplying capacity is 2 to 3 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. Much of the acreage is used for range and wildlife habitat. Major irrigated crops include potatoes, wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the moderately low water capacity and the hazard of soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the moderately low water capacity and high water consumption, light, frequent applications of irrigation water are needed. Because of the slope, irrigation water runoff may be a problem if application rates are too high. Plant nutrients are readily leached out of the root zone because of the moderately rapid permeability. Split applications of fertilizer are desirable.

The hazard of soil blowing is high because of the fine sandy loam surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts, hummocks, and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help in controlling soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation systems before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical. Because the hazard of soil blowing is high, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seeding vigor and be drought resistant. Suitable for seeding is crested or Siberian wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The slope is a limitation for many uses in community development. Variation in design may be needed. The fine sandy loam texture and the slope are limitations for all recreation facilities unless the design is modified.

The capability subclass is VIe dryland, IIIe irrigated.

52D—Royal fine sandy loam, 12 to 20 percent slopes. This is a very deep, well drained soil formed in wind laid material. It occurs at elevations of 300 to 800 feet. The average slope is 15 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 150 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark brown fine sandy loam about 6 inches thick. The subsoil is dark brown very fine sandy loam about 11 inches thick. The substratum is dark brown, dark grayish brown, and very dark gray stratified fine sandy loam, loamy fine sand, and fine sand. It extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Quincy and Burbank soils; 5 percent is Ellum, Sagehill, Irrigon, and Warden soils; and 10 percent is Royal soils that have slopes of 20 to 30 percent.

Permeability is moderately rapid. Effective rooting depth is 40 to 60 inches. Available water capacity is 5 to 9 inches. Water supplying capacity is 2 to 3 inches. Runoff is slow, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is high.

Some of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. Most of the acreage, however, is used for range and wildlife habitat. Major irrigated crops include potatoes, wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the moderately low water capacity, the hazard of soil blowing, and the proper application of irrigation water to prevent water erosion. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the slope, proper application rates of irrigation water are important in order to reduce the hazard of water erosion. Plant nutrients are readily leached out of the root zone because of the moderately rapid permeability. Split applications of fertilizer are desirable.

The hazard of soil blowing is high because of the fine sandy loam texture of the surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts, hummocks, and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help in controlling soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation system before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical. Because the hazard of soil blowing is high, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested or Siberian wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The slope is a limitation for many community and recreation uses.

The capability subclass is VIe dryland, IVe irrigated.

53A—Royal silt loam, 0 to 3 percent slopes. This is a very deep, well drained soil formed in wind laid material. It occupies long, narrow areas of alluvial bottom lands adjacent to streams. The elevation is 300 to 800 feet. The average slope is 1 percent. The average annual precipitation is 7 to 9 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 150 to 200 days at 32 degrees F. and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is dark brown and dark grayish brown fine sandy loam about 27 inches thick. The substratum is dark grayish brown stratified fine sandy loam and fine sand that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Burbank, Quincy, and Royal soils and 5 percent is Xeric Torriorthents.

Permeability is moderately rapid. Effective rooting depth is 40 to 60 inches. Available water capacity is 5 to 9 inches. Water supplying capacity is 2 to 3 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

Although much of the acreage is used for irrigated crops, a considerable acreage is used for range and wildlife habitat. More of the acreage is converted to irrigated cropland every year. Major irrigated crops include potatoes, wheat, corn, alfalfa hay, and pasture.

The major concern in management is the low infiltration rate. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the low infiltration rate, the proper application of irrigation water is especially important where these soils occur in the same field with soils that have a higher infiltration rate. In such instances, one soil can be overirrigated and an adjacent soil underirrigated.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have a strong seedling vigor and be drought resistant.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil is generally well suited to community and recreation uses. Sanitary facilities, such as sewage lagoons and sanitary landfills, may require some modification because of seepage.

The capability subclass is VIe dryland, IIs irrigated.

54B—Sagehill fine sandy loam, 2 to 5 percent slopes. This is a very deep, well drained soil formed in wind laid material and calcareous lacustrine sediment. It is on terraces at elevations of 500 to 1,200 feet. The average slope is 3 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 150 to 200 days at 32 degrees F. and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsoil is dark brown fine sandy loam about 16 inches thick. The upper 7 inches of the substratum is dark brown fine sandy loam. Below this is brown and dark grayish brown silt loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Warden soils and 5 percent is Taunton, Royal, and Gravden soils.

Permeability is moderately rapid as far down as the substratum and moderate in the substratum. The effective rooting depth is restricted by semiconsolidated, water laid silt at a depth of 20 to 40 inches. The available water capacity is 9 to 10.5 inches. The water supplying capacity is 5 to 7 inches. Runoff is slow, and the erosion hazard is slight. The hazard of soil blowing is moderate.

Extensive areas are used for irrigated crops, and many more are converted to irrigated cropland every year. Much of the acreage is used for range and wildlife habitat. Major irrigated crops include potatoes, annual wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the hazard of soil blowing and the proper application of irrigation water. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because the fine sandy loam textured solum overlies a compact, lacustrine silt substratum, ponding results in some areas if too much irrigation water is applied. Proper irrigation rates should be carefully determined in such areas.

The hazard of soil blowing is moderate because of the fine sandy loam texture and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts, hummocks, and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help in controlling soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation system before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is dominated by bluebunch wheatgrass. Sandberg bluegrass and needleandthread are prominent. Perennial forbs, such as Carey balsamroot, wooly indianwheat, and western yarrow, occur in small amounts. Big sagebrush and rubber rabbitbrush are common.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass, low value forbs, and big sagebrush increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass and rabbitbrush commonly dominate the stand.

If the range is in poor condition, seedbed preparation and seeding are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems Direct drill seeding after a fire is a good way of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested or Siberian wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil is generally well suited to community and most recreation uses. Playgrounds in the more sloping areas require leveling.

The capability subclass is VIe dryland, IIe irrigated.

54C—Sagehill fine sandy loam, 5 to 12 percent slopes. This is a very deep, well drained soil formed in wind laid material and calcareous lacustrine sediment. It is on terraces at elevations of 500 to 1,200 feet. The average slope is 8 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 150 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsoil is dark brown fine sandy loam about 16 inches thick. The upper 7 inches of the substratum is dark brown fine sandy loam. Below this is brown and dark grayish brown silt loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Warden soils and 5 percent is Royal, Taunton, and Gravden soils.

Permeability is moderately rapid as far down as the substratum and moderate in the substratum. Effective rooting depth is restricted by semiconsolidated, water laid silt at a depth of 20 to 40 inches. Available water capacity is 9 to 10.5 inches. Water supplying capacity is 5 to 7 inches. Runoff is slow, and the erosion hazard is slight. The hazard of soil blowing is moderate.

Extensive areas are used for irrigated crops, and many more are being converted to irrigated cropland. Much of the acreage is used as range and wildlife habitat. Major irrigated crops include potatoes, annual wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the hazard of soil blowing and the proper application of irrigation water. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because the fine sandy loam textured solum overlies a compact, lacustrine silt substratum, ponding results in some areas if too much irrigation water is applied. Proper irrigation rates should be carefully determined in such areas.

The hazard of soil blowing is moderate because of the fine sandy loam texture and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts, hummocks, and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help in controlling soil blowing include winter cover crops, timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation system before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is dominated by bluebunch wheatgrass. Sandberg bluegrass and needleandthread are prominent. Perennial forbs, such as Carey balsamroot, wooly indianwheat, and western yarrow, occur in small amounts. Big sagebrush and rubber rabbitbrush are common.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass, low value forbs, and big sagebrush increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass and rabbitbrush commonly dominate the stand.

If the range is in poor condition, seedbed preparation and seeding are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. Direct drill seeding after a fire is a good way of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested or Siberian wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The slope is a limitation for most community and recreation development. Variation in design may be required to overcome these limitations.

The capability subclass is VIe dryland, IIIe irrigated.

54D—Sagehill fine sandy loam, 12 to 20 percent slopes. This is a very deep, well drained soil formed in wind laid material and calcareous lacustrine sediment. It is on terraces at elevations of 500 to 1,200 feet. The average slope is 15 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 150 to 200 days at 32 degrees and 180 to 215 days at 28 degrees

In a representative profile the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsoil is dark brown fine sandy loam about 16 inches thick. The upper 7 inches of the substratum is dark brown fine sandy loam. Below this is brown and dark grayish brown silt loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Warden soils and 5 percent is Royal and Gravden soils.

Permeability is moderately rapid as far down as the substratum and moderate in the substratum. Effective rooting depth is restricted by semiconsolidated, water laid silt at a depth of 20 to 40 inches. Available water capacity is 9 to 10.5 inches. Water supplying capacity is 5 to 7 inches. Runoff is medium, and the erosion hazard is moderate. The hazard of soil blowing is moderate.

Areas of this soil are used for irrigated crops, and more areas are converted to irrigated cropland every year. Much of the acreage is used for range and wildlife habitat. Major irrigated crops include potatoes, annual wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the hazard of soil blowing and the proper application of irrigation water to prevent water erosion. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems can arise.

Because the fine sandy loam textured solum overlies a compact, lacustrine silt substratum, infiltration may be impeded, causing runoff. Proper irrigation rates should be carefully determined. If runoff is too great, it results in soil loss through water erosion.

The hazard of soil blowing is moderate because of the fine sandy loam texture and the frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts, hummocks, and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help in controlling soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation system before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is dominated by bluebunch wheatgrass. Sandberg bluegrass and needleandthread are prominent. Perennial forbs, such as Carey balsamroot, wooly indianwheat, and western yarrow, occur in small amounts. Big sagebrush and rubber rabbitbrush are common.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of

Sandberg bluegrass, low value forbs, and big sagebrush increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass and rabbitbrush commonly dominate the stand.

If the range is in poor condition, seedbed preparation and seeding are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. Direct drill seeding after a fire is a good way of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested or Siberian wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The slope is a limitation for most community and recreational development.

The capability subclass is VIe dryland, IVe irrigated.

55B—Sagehill fine sandy loam, hummocky, 2 to 5 percent slopes. This is a very deep, well drained soil formed in wind laid materials and calcareous lacustrine sediment. It is on terraces at elevations of 500 to 1,200 feet. The average slope is 3 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 150 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsoil is dark brown fine sandy loam about 16 inches thick. The upper 7 inches of the substratum is dark brown fine sandy loam. Below this is brown and dark grayish brown silt loam that extends to a depth of 60 inches or more. The surface layer has been eroded in some areas and the material redeposited as small mounds or hummocks.

About 5 percent of this unit is included areas of Warden soils and 10 percent is Royal, Taunton, and Gravden soils.

Permeability is moderately rapid as far down as the substratum and moderate below the substratum. Effective rooting depth is restricted by semiconsolidated, water laid silt at a depth of 20 to 40 inches. Available water capacity is 9 to 10.5 inches. Water supplying capacity is 5 to 7 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used entirely as range and wildlife habitat. If leveled, many areas could be converted to irrigated cropland. Management would be the same as for Sagehill fine sandy loam, 2 to 5 percent slopes

The native plant community is dominated by bluebunch wheatgrass. Sandberg bluegrass and needleandthread are prominent. Perennial forbs, such as Carey balsamroot, wooly indianwheat, and western yarrow, occur in small amounts. Big sagebrush and rubber rabbitbrush are common.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass, low value forbs, and big sagebrush increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass and rabbitbrush commonly dominate the stand.

If the range is in poor condition, seedbed preparation and seeding are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. Direct drill seeding after a fire is a good way of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested or Siberian wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The slope and rapid percolation are limitations for community developments. Modifications in design are needed for small buildings, dwellings, and sanitary facilities. This soil has no serious limitations for recreation uses, but playgrounds may require leveling.

The capability subclass is VIe dryland, IIIe irrigated.

55C—Sagehill fine sandy loam, hummocky, 5 to 12 percent slopes. This is a very deep, well drained soil formed in wind laid material and calcareous lacustrine sediment. It is on terraces at elevations of 500 to 1,200 feet. The average slope is 8 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 150 to 200 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsoil is dark brown fine sandy loam about l6 inches thick. The upper 7 inches of the substratum is dark brown fine sandy loam. Below this is brown and dark grayish brown silt loam that extends to a depth of 60 inches or more. The surface layer, eroded from some areas, has been redeposited as small mounds or hummocks.

About 10 percent of this unit is included areas of Warden, Royal, Taunton, and Gravden soils.

Permeability is moderately rapid as far down as the substratum and moderately slow in the substratum. Effective rooting depth is restricted by semiconsolidated, water laid silt at a depth of 20 to 40 inches. Available water capacity is 9 to 10.5 inches. Water supplying capacity is 5 to 7 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This soil is used entirely for range and wildlife habitat. If leveled, it would be suitable for irrigated crops, and management would be the same as for Sagehill fine sandy loam, 5 to 12 percent slopes.

The native plant community is dominated by bluebunch wheatgrass. Sandberg bluegrass and needleandthread are prominent. Perennial forbs, such as Carey balsamroot, wooly indianwheat, and western yarrow, occur in small amounts. Big sagebrush and rubber rabbitbrush are common.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass, low value forbs, and big sagebrush increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass and rabbitbrush commonly dominate the stand.

If the range is in poor condition, seedbed preparation and seeding are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. Direct drill seeding after a fire is a good way of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested or Siberian wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The slope and rapid percolation are limitations for community and most recreation uses. Modifications in design are needed for small buildings, dwellings, sanitary facilities, and recreation facilities.

The capability subclass is VIe dryland, IIIe irrigated.

56F—Snell very stony loam, 35 to 70 percent north slopes. This is a moderately deep, well drained soil formed in loess mixed with basalt colluvium. It is on north-facing slopes on uplands at elevations of 2,500 to 4,000 feet. The average slope is 50 percent. The average annual precipitation is 15 to 20 inches, and the average annual air temperature is 43 to 45 degrees F. The frost free period is 60 to 95 days at 32 degrees and 90 to 110 days at 28 degrees.

In a representative profile the surface layer is black and very dark brown very stony loam and silty clay loam about 14 inches thick. The subsoil is very dark brown and dark yellowish brown very cobbly silty clay loam and extremely cobbly silty clay loam about 16 inches thick. Fractured basalt is at a depth of about 30 inches.

About 2 percent of this unit is included areas of Rock outcrop and 10 percent is Waha soils.

Permeability is moderately slow. Available water capacity is 1.5 to 4 inches. Water supplying capacity is 7 to 12 inches. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This soil is used for livestock grazing and wildlife habitat.

The native plant community is dominated by Idaho fescue. Bluebunch wheatgrass and Cusick bluegrass are prominent. Sandberg bluegrass and a wide variety of perennial forbs occur throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, the proportion of Idaho fescue and Cusick bluegrass decreases and the proportion of bluebunch wheatgrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, annual grasses and low value forbs are prominent.

Because of the steep slopes and the surface stones, seedbed preparation and range seeding are not practical.

Mule deer use this plant community in the summer and fall because of the cooler temperatures and proximity to cover.

The depth to rock, stoniness, and very steep slopes are severe limitations for community and recreation uses. Extensive design modifications are needed but are rarely practical for dwellings, small buildings, sanitary facilities, and recreation facilities.

The capability subclass is VIIs.

57—Snow silt loam. This is a very deep, well drained soil that formed in alluvium derived from loess and volcanic ash. It is on alluvial bottom land at elevations of 2,200 to 3,200 feet. The average slope is 1 percent. The average annual precipitation is about 14 to 20 inches, and the average annual air temperature is about 46 to 48 degrees F. The frost free period is 115 to 125 days at 32 degrees and 125 to 160 days at 28 degrees.

In a representative profile the surface layer is black and very dark brown silt loam about 33 inches thick. The subsoil is very dark grayish brown silt loam about 13 inches thick. The substratum is very dark grayish brown loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Onyx, Pedigo, and Endersby soils.

Permeability is moderate. Available water capacity is 11 to 12 inches. Water supplying capacity is 9 to 15 inches. Effective rooting depth is more than 60 inches. Runoff is slow, and the hazard of erosion is slight. This soil is subject to rare flooding.

Nearly all the acreage is used for dryland or irrigated crops. Hay and pasture are the main crops. Some winter wheat is also grown. Some irregularly shaped areas are used as range.

The major needs in crop management are conserving soil moisture for plant growth and stabilizing streambanks against cutting by water. The proper timing and rates of applying irrigation water are important. Where water is available, irrigation is by sprinklers, most commonly wheelline or handline systems.

A suitable cropping system under irrigation is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Split applications of fertilizer are desirable because plant nutrients are leached out of the root zone by the irrigation water.

In dryfarmed areas where wheat is grown, stubble mulch and minimum tillage along with a crop-fallow system help to minimize erosion and conserve soil moisture.

Streambanks can be stabilized by maintaining streamside vegetation, especially giant wildrye, and riparian shrubs, such as lilac or willow. Such vegetation also serves as important wildlife cover.

For dryland pasture and hay, suitable grasses and legumes grown alone or in various combinations are alfalfa, dwarf yellow sweetclover, Siberian wheatgrass, beardless wheatgrass, crested wheatgrass, intermediate wheatgrass, pubescent wheatgrass, tall wheatgrass, big bluegrass, hard fescue, and smooth bromegrass (*3*).

Areas of this soil support populations of upland game birds, such as ring-necked pheasant and valley quail. Mule deer use areas of this soil and the adjacent south-facing slopes in winter. The soil also provides food and cover for smaller mammals.

Because this soil occurs on stream flood plains, it is subject to rare flooding, which results in limitations for many community developments. The soil has no serious limitations for recreation facilities. Campgrounds, however, are limited by the flooding.

The capability subclass is IIc dryland and class I irrigated.

58A—Taunton fine sandy loam, 0 to 2 percent slopes. This is a moderately deep, well drained soil formed in old alluvium reworked by wind. It is on terraces at elevations of 700 to 1,000 feet. The average slope is 1 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 150 to 180 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsoil is dark brown fine sandy loam about 10 inches thick. The substratum is dark brown, calcareous very fine sandy loam about 17 inches thick. A cemented, calcareous hardpan is at a depth of about 32 inches.

About 10 percent of this unit is included areas of Sagehill and Warden soils and 5 percent is Gravden soils

Permeability is moderately rapid. Available water capacity is 2.5 to 6 inches. Water supplying capacity is 4 to 7 inches. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

Much of the acreage is used for irrigated crops and more is converted to irrigated cropland every year. A large part of the acreage is used for range and wildlife habitat. Major irrigated crops include potatoes, corn, wheat, alfalfa hay, and pasture.

Major concerns in management are the hazard of soil blowing and the proper application of irrigation water. Where water is available, irrigation is by sprinklers, commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa hay If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the moderately low water capacity and high water consumption, light, frequent applications of irrigation water are needed. Because of the impervious cemented hardpan at a depth of 20 to 40 inches, overirrigation will result in ponding

The hazard of soil blowing is moderate because of the fine sandy loam texture of the surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help in controlling soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation systems before the land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbances, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The cemented hardpan is a limitation for sanitary facilities and other community development, such as dwellings and commercial buildings. The soil is suitable for the construction of roads and streets. Recreation facilities have few limitations.

The capability subclass is IIIe irrigated, VIe dryland.

58B—Taunton fine sandy loam, 2 to 5 percent slopes. This is a moderately deep, well drained soil formed in old alluvium that has been reworked by wind. It is on terraces at elevations of 700 to 1,000 feet. The average slope is 3 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 150 to 180 days at 32 degrees and 180 to 215 days at 28 degrees F.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsoil is dark brown fine sandy loam about 10 inches thick. The substratum is dark brown, calcareous very fine sandy loam about 17 inches thick. A cemented, calcareous hardpan is at a depth of about 32 inches.

About 10 percent of this unit is included areas of Sagehill and Warden soils and 5 percent is Gravden soils.

Permeability is moderately rapid. Available water capacity is 2.5 to 6 inches. Water supplying capacity is 4 to 7 inches. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. A large acreage is used for range and wildlife habitat. Major irrigated crops are potatoes, annual wheat, alfalfa hay, and pasture.

Major concerns in management are the hazard of soil blowing and the proper application of irrigation water. Where water is available, irrigation is by sprinklers, commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the moderately low water capacity and high water consumption, light, frequent applications of irrigation water are needed. Because of the impervious cemented hardpan at a depth of 20 to 40 inches, overirrigation should be avoided. It can cause ponding, and in the steeper areas runoff may occur, resulting in erosion.

The hazard of soil blowing is moderate because of the fine sandy loam texture of the surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help in controlling soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation system before land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant.

Livestock grazing shoud be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The cemented hardpan is a limitation for sanitary facilities. Other uses for community development, such as dwellings and commercial buildings, are limited because of the pan and the low strength of the soil. This soil is suitable for the construction of roads and streets. There are few limitations for most recreation facilities.

The capability subclass is IIIe irrigated, VIe dryland.

58C—Taunton fine sandy loam, 5 to 12 percent slopes. This is a moderately deep, well drained soil formed in old alluvium reworked by wind. It is on terraces at elevations of 700 to 1,000 feet. The average slope is 8 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 150 to 180 days at 32 degrees F. and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsoil is dark brown fine sandy loam about 10 inches thick. The substratum is dark brown, calcareous very fine sandy loam about 17 inches thick. A cemented calcareous hardpan is at a depth of about 32 inches.

About 10 percent of this unit is included areas of Sagehill and Warden soils and 5 percent is Gravden soils.

Permeability is moderately rapid. Available water capacity is 2.5 to 6 inches. The water supplying capacity is 4 to 7 inches. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

Much of the acreage is used for irrigated crops, and more is converted to irrigated cropland every year. A large part of this soil is used as range and wildlife habitat. Major irrigated crops include potatoes, annual wheat, alfalfa hay, and pasture.

Major concerns in management are the hazard of soil blowing and the proper application of irrigation water. Where water is available, irrigation is by sprinklers, commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa hay If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

Because of the moderately low water capacity and high water consumption, light, frequent applications of irrigation water are needed. Because of the impervious cemented hardpan at a depth of 20 to 40 inches, overirrigation can cause excess water to run off and result in erosion.

The hazard of soil blowing is moderate because of the fine sandy loam texture of the surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help in controlling soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; and planting of row crops perpendicular to the wind direction. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation system before the land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbances, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The cemented hardpan is a limitation for sanitary facilities. Commercial buildings may need variations in design because of the slope. Construction of dwellings is limited because of the slope and low strength of the soil. Dwellings with basements may require design modification because of the cemented hardpan. The slope is a limitation for roads, streets, and recreation facilities.

The capability subclass is VIe dryland, IIIe irrigated.

59B—Taunton fine sandy loam, hummocky, 0 to 5 percent slopes. This is a moderately deep, well drained soil formed in old alluvium reworked by wind. It is on terraces at elevations of 700 to 1,000 feet. The average slope is 2 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 150 to 180 days at 32 degrees and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsoil is dark brown fine sandy loam about 10 inches thick. The substratum is dark brown, calcareous very fine sandy loam about 17 inches thick. A cemented, calcareous hardpan is at a depth of about 32 inches. The surface layer has been eroded from some areas and the material redeposited as small mounds or hummocks.

About 10 percent of this unit is included areas of Sagehill and Warden soils and 5 percent Gravden soils.

Permeability is moderately rapid. Available water capacity is 2.5 to 6 inches. Water supplying capacity is 4 to 7 inches Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used as range and wildlife habitat. Many areas are suitable for leveling and conversion to irrigated cropland. Because a cemented hardpan is at a depth of 20 to 40 inches, however, care is needed in leveling not to expose this pan. If leveled, the soil is suitable for irrigated crops. Management is the same as for Taunton fine sandy loam, 0 to 2 percent slopes.

The native plant community is a good stand of needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbances, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding to dryland grasses are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. Direct drill seeding after a fire is a good method of restoring production in a reasonable length of time. Grasses selected for dryland seeding should have strong seedling vigor and be drought resistant.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The cemented hardpan and seepage are limitations for the development of sanitary facilities. Other uses for community development, such as dwellings and commercial buildings, are limited by the pan and the low strength of the soil. This soil is suitable for the construction of roads and streets. It has no serious limitations for paths or trails. Playgrounds may require leveling.

The capability subclass is VIe dryland, IIIe irrigated.

60C—Tolo silt loam, 3 to 15 percent slopes. This is a very deep, well drained soil formed in volcanic ash and wind laid silt mixed with granite and basalt colluvium. It is on uplands of the Blue Mountains at elevations of 3,500 to 4,600 feet. The average slope is about 6 percent. The average annual precipitation is 18 to 25 inches, and the average annual air temperature is 42 to 45 degrees F. The frost free period is 50 to 80 days at 32 degrees and 80 to 110 days at 28 degrees.

In a representative profile the surface layer is very dark brown silt loam about 3 inches thick. The subsoil is yellowish brown and very pale brown silt loam about 22 inches thick. The buried substratum is dark brown loam and cobbly silty clay loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Boardtree soils and 10 percent is Klicker, Hankins, and Hall Ranch soils.

Permeability is moderately slow. Available water capacity is 11 to 18 inches. Water supplying capacity is 15 to 20 inches. Effective rooting depth is more than 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This soil is used for timber, range, recreation, and wildlife habitat.

This soil is suited to the production of ponderosa pine. At a site index of 100 (*8*), it is capable of producing about 4,080 cubic feet of timber from a fully stocked stand at 40 years or 44,600 board feet (Scribner) of merchantable timber from a fully stocked stand at 120 years.

This soil is suited to tractor logging. Excessive soil disturbance should be avoided because removing the overlying ash layer and exposing the less fertile buried horizon adversely affect natural regeneration. If enough of this ash layer is removed, the productivity of the area affected will be lowered permanently. Excessive soil disturbance may also result in severe erosion and deterioration of water quality. The 20- to 40-inch ash layer makes the construction and maintenance of roads difficult. This material makes poor subgrade for roads. It does not compact easily, and it has high potential frost action and a high water holding capacity. The amount of ballast depends on the number and type of vehicles on the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is a mixed fir forest. The canopy cover is 40 to 70 percent. Western larch is subordinate in the stand. Under this canopy cover, the foliar understory does not provide significant forage for domestic livestock. It is about 15 percent common snowberry, 5 percent each bearberry and pachistima, 10 percent elk sedge, and about 5 percent peavine, a prominent forb. The understory of shade tolerant shrubs, forbs, and grasses decreases as the tree cover increases, but it provides considerable forage as long as the canopy remains open.

Following fire or logging, broadcast seeding is advisable before fall rains. A major objective of seeding is to stabilize disturbed soil areas. Suitable for seeding are orchardgrass, timothy, hard fescue, and white clover.

Mule deer use this plant community in summer and autumn for food and cover. At lower elevations, the plant community is in the winter range of Rocky Mountain elk, and it is used for cover during daytime and winter storms. A variety of small mammals and birds, including game birds such as blue and ruffed grouse, also use this community.

Because of the remote location and severe climate, most community developments are likely to be for recreation. Some variation in design may be required for dwellings and small buildings because of the low strength of the soil material. The moderately slow permeability and slope are limitations for septic tank absorption systems.

The capability subclass is VIe.

60E—Tolo silt loam, 15 to 35 percent slopes. This is a very deep, well drained soil formed in volcanic ash, wind laid silt, and granite and basalt colluvium. It is on uplands of the Blue Mountains at elevations of 3,500 to 4,600 feet. The average slope is about 6 percent. The average annual precipitation is 18 to 25 inches, and the average annual air temperature is 42 to 45 degrees F. The frost free period is 30 to 60 days at 32 degrees and 80 to 110 days at 28 degrees.

In a representative profile the surface layer is very dark brown silt loam about 3 inches thick. The subsoil is yellowish brown and very pale brown silt loam about 22 inches thick. The buried substratum is dark brown loam and cobbly silty clay loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Boardtree soils; 10 percent is Klicker, Hankins, and Hall Ranch soils; and 5 percent is ashy skeletal soils.

Permeability is moderately slow. Available water capacity is 11 to 18 inches. Water supplying capacity is 15 to 20 inches. Effective rooting depth is more than 60 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

The soil is used for timber, range, recreation, and wildlife habitat.

This soil is suited to the production of ponderosa pine. At a site index of 100 (*8*), it is capable of producing about 4,080 cubic feet of timber from a fully stocked stand at 40 years or 44,600 board feet (Scribner) of merchantable timber from a fully stocked stand at 120 years.

Tractor logging is practical in most areas. In steeper areas, cable logging may be desirable. Excessive soil disturbance should be avoided because removing the overlying ash layer and exposing the less fertile buried horizon adversely affect natural regeneration. If enough of this ash layer is removed, the productivity of the area affected may be lowered permanently. Excessive soil disturbance may also result in severe erosion and deterioration of water quality. The steep slopes and the 20- to 40-inch ash layer make the construction and maintenance of roads difficult. The ash layer provides poor subgrade for roads. It does not compact easily, and it has high potential frost action and a high water holding capacity. The amount of ballast depends on the number and type of vehicles using the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is a mixed fir forest. The tree canopy cover is 40 to 70 percent. Western larch is subordinate in the stand. Under this canopy cover, the foliar understory does not provide significant forage for domestic livestock. It is about 15 percent common snowberry, 5 percent each bearberry and pachistima, 10 percent elk sedge, and about 5 percent peavine, a prominent forb. The understory of shade tolerant shrubs, forbs, and grasses decreases as the tree cover increases, but it provides considerable forage as long as the canopy remains open.

Following fire or logging, broadcast seeding is advisable before fall rains. A major objective of seeding is to stabilize disturbed soil areas. Suitable for seeding are orchardgrass, timothy, hard fescue, and white clover.

Mule deer use this plant community in summer and autumn for food and cover. At lower elevations, the plant community is in the winter range of Rocky Mountain elk, and it is used for cover during daytime and winter storms. A variety of small mammals and birds, including game birds such as blue and ruffed grouse, also use this community.

Because of the remote location of this soil and the severe climate, most anticipated community developments are likely to be for recreation Some variation in design may be required for dwellings and small buildings because of the low strength of the soil material and slope. The slope generally is a limitation for septic tank absorption systems.

The capability subclass is VIe.

60F—Tolo silt loam, 35 to 60 percent slopes. This is a very deep, well drained soil formed in volcanic ash, wind laid silt, and granite and basalt colluvium. It is on uplands of the Blue Mountains at elevations of 3,500 to 4,600 feet. The average slope is about 6 percent. The average annual precipitation is 18 to 25 inches, and the average annual air temperature is 42 to 45 degrees F. The frost free period is 30 to 60 days at 32 degrees and 80 to 110 days at 28 degrees.

In a representative profile the surface layer is very dark brown silt loam about 3 inches thick. The subsoil is yellowish brown and very pale brown silt loam about 22 inches thick. The buried substratum is dark brown loam and cobbly silty clay loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Boardtree soils; 10 percent is Klicker, Hankins, and Hall Ranch soils; and 10 percent is ashy skeletal soils.

Permeability is moderately slow. Available water capacity is 11 to 18 inches. Water supplying capacity is 15 to 20 inches. Effective rooting depth is more than 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The soil is used for timber, range, recreation, and wildlife habitat.

This soil is suited to the production of ponderosa pine. At a site index of 100 (*8*), it is capable of producing about 4,080 cubic feet of timber from a fully stocked stand at 40 years or 44,600 board feet (Scribner) of merchantable timber from a fully stocked stand at 120 years.

Because of the slope, the only practical method of logging is by cable. Excessive soil disturbance should be avoided because removing the overlying ash layer and exposing the less fertile buried horizons adversely affect natural regeneration. If enough of this ashy layer is removed, the productivity of the area affected may be lowered permanently. Excessive soil disturbance may also result in severe erosion and deterioration of water quality. The steep slopes and the 20- to 40-inch ash layer make construction and maintenance of roads difficult. The ash layer provides poor subgrade for roads. It does not compact easily, and it has high potential frost action and a high water holding capacity. The amount of ballast depends on the number and type of vehicles on the road and the months of the year that the road is used. Use early in spring should be limited.

The native vegetation is a mixed fir forest. The canopy cover is 40 to 70 percent. Western larch is subordinate in the stand. Under this canopy cover, the foliar understory does not provide significant forage for domestic livestock. It is about 15 percent common snowberry, 5 percent each bearberry and pachistima, 10 percent elk sedge, and about 5 percent peavine, a prominent forb. The understory of shade tolerant shrubs, forbs, and grasses decreases as the tree cover increases, but it provides considerable forage as long as the canopy is open.

Following fire or logging, broadcast seeding is advisable before fall rains. A major objective of seeding is to stabilize disturbed soil areas. Suitable for seeding are orchardgrass, timothy, hard fescue, and white clover.

Mule deer use this plant community in summer and autumn for food and cover. At lower elevations, the plant community is in the winter range for Rocky Mountain elk, and it is used for cover in daytime and winter storms. A variety of small mammals and birds, including game birds such as blue and ruffed grouse, also use this community.

In most places, community and recreation uses are not practical because of the steep slope.

The capability subclass is VIIe.

61E—Ukiah stony silty clay loam, 5 to 30 percent slopes. This is a moderately deep, well drained soil formed in colluvium from volcanic tuff. It is on south-facing slopes on uplands at elevations of 3,500 to 4,500 feet. The average slope is 20 percent. The average annual precipitation is 17 to 20 inches, and the average annual air temperature is 47 to 49 degrees. The frost free period is 80 to 110 days at 32 degrees F.

In a representative profile the surface layer is black and very dark brown stony silty clay loam about 7 inches thick. The subsoil is dark brown and brown cobbly clay about 19 inches thick. Soft, partly weathered volcanic tuff is at a depth of about 26 inches.

About 5 percent of this unit is included areas of Waterbury and Hankins soils.

Permeability is very slow. Available water capacity is 2 to 6 inches. Water supplying capacity is 6 to 12 inches. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This soil is used for livestock grazing and wildlife habitat.

The potential native vegetation is a plant community dominated by bluebunch wheatgrass. Idaho fescue and Sandberg bluegrass are prominent. A variety of perennial forbs, such as arrowleaf balsamroot, milkvetch, and yarrow, occurs throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, plant vigor is greatly reduced and the proportion of bluebunch wheatgrass and other desirable grasses decreases. If deterioration is severe, cheatgrass and other low value plants predominate and the hazard of erosion is high.

If the range is in poor condition, seedbed preparation and seeding of the more gently sloping areas are practical. Suitable for dryland seeding are beardless wheatgrass, big bluegrass, crested wheatgrass, and alfalfa.

The plant community provides food for Rocky Mountain elk and mule deer in winter and early in spring when other areas are snow covered.

The depth to rock, slope, high clay content, and high shrink-swell potential are limitations for community developments. Extensive design modifications are needed but are rarely practical for dwellings, small buildings, and sanitary facilities. The stones and slope are limitations for recreation facilities.

The capability subclass is VIIs.

62D—Utley loam, 8 to 20 percent slopes. This is a very deep, well drained soil formed in material derived from basalt and soft volcanic rock. It is on foot slopes at elevations of 3,500 to 4,200 feet. The average slope is about 12 percent. The average annual precipitation is 20 to 23 inches, and the mean annual air temperature is 42 to 45 degrees F. The frost free period is 40 to 70 days at 32 degrees.

In a representative profile the upper 6 inches of the surface layer is very dark brown loam, and the lower 10 inches is very dark grayish brown loam. The subsoil is dark grayish brown shaly loam about 22 inches thick. The substratum is dark grayish brown very shaly loam that extends to a depth of 60 inches or more.

About 15 percent of this unit is included areas of Waha soils and 5 percent is Waterbury soils.

Permeability is moderate. Available water capacity is 6 to 10 inches. Water supplying capacity is 11 to 14 inches. Effective rooting depth is more than 40 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for livestock grazing and wildlife habitat.

The native plant community is Idaho fescue, Sandberg bluegrass, and bluebunch wheatgrass. A variety of perennial forbs occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, the proportion of Idaho fescue decreases and the proportion of bluebunch wheatgrass and Sandberg bluegrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, annuals and other less desirable grasses and forbs are prominent.

If the range is in poor condition, seedbed preparation and seeding are practical. Suitable for dryland seeding are intermediate wheatgrass, beardless wheatgrass, hard fescue, and alfalfa.

Areas of this soil provide good habitat for mule deer, small mammals, and game birds.

The slope is a limitation for community and recreation uses. Modifications in design are needed.

The capability subclass is VIe.

63B—Valby silt loam, 1 to 7 percent slopes. This is a moderately deep soil formed in loess mixed with some ash over basalt. It is on uplands of the Columbia Plateau at elevations of 1,600 to 3,600 feet. The average annual precipitation is 11 to 14 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free season is 110 to 150 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is very dark grayish brown and dark brown heavy silt loam about 17 inches thick. The substratum is dark brown, calcareous silt loam about 5 inches thick. Fractured basalt is at a depth of about 30 inches.

About 10 percent of this unit is included areas of Rhea soils and 5 percent is Bakeoven and Lickskillet soils.

Permeability is moderate. Available water capacity is 4 to 8.5 inches. Water supplying capacity is 6 to 8 inches. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of erosion is slight.

Nearly all the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. The rest of the acreage is used for range and wildlife habitat.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system help to maintain soil moisture. Cross-slope tillage in the more level areas and contour tillage and diversions in the steeper areas are desirable, especially where slopes are long.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass. For dryland hay and pasture, suitable grasses and legumes grown alone or in combination are alfalfa, big bluegrass, crested wheatgrass, Siberian wheatgrass, and intermediate wheatgrass (*3*).

The native plant community is dominated by bluebunch wheatgrass and Idaho fescue. Sandberg bluegrass is prominent. A variety of perennial forbs occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass and Idaho fescue decrease and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, cheatgrass, low value forbs, and shrubs predominate.

If range is in poor condition, seedbed preparation and seeding are practical. Suitable for dryland seeding are big bluegrass, crested wheatgrass, beardless wheatgrass, and alfalfa.

Mule deer use this plant community in spring and again in fall when plants are green and succulent. The plant community also provides food for small mammals and game birds.

The depth to bedrock is a limitation for community uses. Design modifications are needed for dwellings, small buildings, and sanitary facilities. This soil has no serious limitations for recreation facilities. Playgrounds in the most sloping areas may need to be leveled.

The capability subclass is IIIs dryland.

63C—Valby silt loam, 7 to 12 percent slopes. This is a moderately deep soil formed in loess mixed with some ash over basalt bedrock. It is on uplands of the Columbia Plateau at elevations of 1,600 to 3,600 feet. The average annual precipitation is 11 to 14 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free season is 110 to 150 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is very dark grayish brown and dark brown heavy silt loam about 17 inches thick. The substratum is dark brown, calcareous silt loam about 5 inches thick. Fractured basalt is at a depth of about 30 inches.

About 10 percent of this unit is included areas of Rhea soils and 5 percent is Bakeoven and Lickskillet soils.

Permeability is moderate. Available water capacity is 4 to 8.5 inches. Water supplying capacity is 6 to 8 inches. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate.

Most of the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. The rest of the acreage is used for range and wildlife habitat.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Cross-slope tillage, contour tillage, and diversions are generally needed to prevent severe erosion from rapid runoff during high intensity rainfall or snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass. For dryland hay and pasture, suitable grasses and legumes grown alone or in combination are alfalfa, big bluegrass, crested wheatgrass, Siberian wheatgrass, and intermediate wheatgrass (*3*).

The native plant community is dominated by bluebunch wheatgrass and Idaho fescue. Sandberg bluegrass is prominent. A variety of perennial forbs occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass and Idaho fescue decrease and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, cheatgrass, low value forbs, and shrubs predominate.

If the range is in poor condition, seedbed preparation and seeding are practical. Suitable for dryland seeding are big bluegrass, crested wheatgrass, beardless wheatgrass, and alfalfa.

Mule deer use this plant community in spring and again in fall when plants are green and succulent. The plant community also provides food for small mammals and game birds.

The slope and depth to bedrock are limitations for community and most recreation uses. Design modifications are needed for dwellings, small buildings, sanitary facilities, and recreation facilities.

The capability subclass is IIIe dryland.

64D—Valby silt loam, 12 to 20 percent north slopes. This is a moderately deep soil formed in loess mixed with some ash over basalt bedrock. It is on uplands of the Columbia Plateau at elevations of 1,600 to 3,600 feet. The average annual precipitation is 11 to 14 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free season is 110 to 150 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is very dark grayish brown and dark brown heavy silt loam about 17 inches thick. The substratum is dark brown, calcareous silt loam about 5 inches thick. Fractured basalt is at a depth of about 30 inches.

About 15 percent of this unit is included areas of Rhea soils and 2 percent is Bakeoven and Lickskillet soils.

Permeability is moderate. Available water capacity is 4 to 8.5 inches. Water supplying capacity is 6 to 8 inches. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate.

About half the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. The rest of the acreage is used for range and wildlife habitat.

The major needs in crop management are protecting the soil from water erosion and conserving soil moisture. Stubble mulch and minimum tillage along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage and diversions help to prevent erosion from rapid runoff during high intensity rainfall and snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

For dryland hay, suitable grasses and legumes grown alone or in combination are alfalfa, big bluegrass, crested wheatgrass, Siberian wheatgrass, and intermediate wheatgrass (*3*).

The native plant community is dominated by bluebunch wheatgrass and Idaho fescue. On north-facing slopes, Idaho fescue may be dominant. Sandberg bluegrass and a variety of perennial forbs occur throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass and Idaho fescue decrease and the proportion of Sandberg bluegrass and perennial forbs increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, annual weeds, lupine, and low value shrubs predominate.

If the range is in poor condition, seedbed preparation and seeding of the more gently sloping areas to grass are practical. Suitable for dryland seeding are big bluegrass, crested wheatgrass, beardless wheatgrass, and alfalfa.

The plant community provides food for mule deer, small mammals, and game birds.

The slope and depth to bedrock are severe limitations for community and recreation uses. Extensive design modifications are needed for dwellings, small buildings, sanitary facilities, and recreation facilities.

The capability subclass is IIIe.

65D—Valby soil loam, 12 to 20 percent south slopes. This is a moderately deep soil formed in loess mixed with some ash over basalt bedrock. It is on uplands of the Columbia Plateau at elevations of 1,600 to 3,600 feet. The average annual precipitation is 11 to 14 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free season is 110 to 150 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is very dark grayish brown and dark brown heavy silt loam about 17 inches thick. The substratum is dark brown, calcareous silt loam about 5 inches thick. Fractured basalt is at a depth of about 30 inches.

About 15 percent of this unit is included areas of Bakeoven and Lickskillet soils.

Permeability is moderate. Available water capacity is 4 to 8.5 inches. Water supplying capacity is 6 to 8 inches. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate.

About half the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Barley is commonly grown. Some dryland hay is also grown. The rest of the acreage is used for range, dryland pasture, and wildlife habitat.

The major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch and minimum tillage along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage and diversions help to prevent severe erosion from rapid runoff during high intensity rainfall and snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen is applied in spring or fall.

For dryland hay, suitable grasses and legumes grown alone or in combination are alfalfa, big bluegrass, crested wheatgrass, Siberian wheatgrass, and intermediate wheatgrass (*3*).

The native plant community is dominated by bluebunch wheatgrass. Sandberg bluegrass and Thurber needlegrass are prominent. A variety of perennial forbs occurs throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and Thurber needlegrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, much of the surface is left bare and the hazard of erosion is high.

If the range is in poor condition, seedbed preparation and seeding of the more gently sloping areas to grass are practical. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

The slope and depth to bedrock are limitations for community and recreation uses. Extensive design modifications are needed for dwellings, small buildings, sanitary facilities, and recreation facilities.

The capability subclass is IVe dryland.

65E—Valby silt loam, 20 to 30 percent south slopes. This is a moderately deep soil formed in loess mixed with some ash over basalt bedrock. It is on uplands of the Columbia Plateau at elevations of 1,600 to 3,600 feet. The average annual precipitation is 11 to 14 inches, and the average annual air temperature is 47 to 51 degrees F. The frost free period is 110 to 150 days at 32 degrees and 150 to 200 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is very dark grayish brown and dark brown heavy silt loam about 17 inches thick. The substratum is dark brown, calcareous silt loam about 5 inches thick. Fractured basalt is at a depth of about 30 inches.

About 10 percent of this unit is included areas of Bakeoven and Lickskillet soils and 5 percent is Wrentham and Rhea soils.

Permeability is moderate. Available water capacity is 4 to 8.5 inches. Water supplying capacity is 6 to 8 inches. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

Most of the acreage is used for range and wildlife habitat. The rest is under a grain-fallow cropping system. Wheat and barley are grown.

The native plant community is dominantly bluebunch wheatgrass. Sandberg bluegrass and Thurber needlegrass are prominent. A variety of perennial forbs occurs throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and Thurber needlegrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, much of the surface is left bare and the hazard of erosion is high.

If the range is in poor condition, seedbed preparation and seeding of the more gently sloping areas to grass are practical. Suitable for dryland seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

If this soil is dryfarmed, stubble mulch and minimum tillage along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage and diversions help to prevent erosion from rapid runoff during high intensity rainfall and snowmelt.

The slope and depth to bedrock are limitations for community and recreation uses. Extensive and expensive design modifications are needed for dwellings, small buildings, sanitary facilities, and recreation facilities.

The capability subclass is IVe dryland.

66B—Waha silt loam, 1 to 7 percent slopes. This is a moderately deep, well drained soil formed in loess. It is at elevations of 2,800 to 4,300 feet. The average slope is 5 percent. The average annual precipitation is 16 to 20 inches, and the average annual air temperature is 45 to 49 degrees F. The frost free period is 100 to 120 days at 32 degrees and 110 to 150 days at 28 degrees.

In a representative profile the surface layer is black and very dark grayish brown silt loam about 12 inches thick. The subsoil is very dark grayish brown and dark brown silty clay loam about 17 inches thick. It is very gravelly in the lower part. Fractured basalt is at a depth of about 29 inches.

About 5 percent of this unit is included areas of Waterbury and Rockly soils.

Permeability is moderately slow. Available water capacity is 3.5 to 8 inches. Water supplying capacity is

7.5 to 12 inches. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of erosion is slight.

Nearly all the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Barley is commonly grown. Some dryland hay is also grown. The rest of the acreage is used for range, dryland pasture, and wildlife habitat.

The major need in crop management is conserving soil moisture.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system help to maintain soil moisture. Cross-slope tillage in the more level areas and contour tillage and diversions are desirable, particularly where slopes are long.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, about 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, intermediate wheatgrass, and hard fescue. For dryland hay, suitable grasses grown alone or in combination are alfalfa, intermediate wheatgrass, beardless wheatgrass, hard fescue, tall wheatgrass, and smooth bromegrass (*3*).

The native plant community is dominated by Idaho fescue, Sandberg bluegrass, and bluebunch wheatgrass. A variety of perennial forbs occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, the proportion of Idaho fescue decreases and the proportion of bluebunch wheatgrass and Sandberg bluegrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, annuals and other less desirable grasses and forbs are prominent.

If the range is in poor condition, seedbed preparation and seeding are practical. Suitable for dryland seeding are intermediate wheatgrass, beardless wheatgrass, hard fescue, and alfalfa.

Areas of this soil provide good habitat for mule deer, small mammals, and game birds.

Use for community development is limited. Depth to bedrock is a limitation for sanitary facilities and dwellings with basements.

The depth to bedrock and slope are limitations for development of roads, streets, and dwellings without basements. This soil has no serious limitations for recreation use, but playgrounds should be leveled in the more sloping areas.

The capability subclass is IIIe.

67D—Waha silt loam, 7 to 25 percent north slopes. This is a moderately deep, well drained soil formed in loess. It is at elevations of 2,800 to 4,300 feet. The average slope is 15 percent. The average annual precipitation is 16 to 20 inches, and the average annual air temperature is 45 to 49 degrees F. The frost free period is 100 to 120 days at 32 degrees and 110 to 150 days at 28 degrees.

In a representative profile the surface layer is black and very dark grayish brown silt loam about 12 inches thick. The subsoil is very dark grayish brown and dark brown silty clay loam about 17 inches thick. It is very gravelly in the lower part. Fractured basalt is at a depth of about 29 inches.

About 5 percent of this unit is included areas of Waterbury and Rockly soils and 2 percent is Rock outcrop and ash pockets.

Permeability is moderately slow. Available water capacity is 3.5 to 8 inches. Water supplying capacity is 7.5 to 12 inches. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate.

About 60 percent of the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Barley is commonly grown. Some dryland hay and pasture are also grown. The rest of the acreage is used for range and wildlife habitat.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch and minimum tillage along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage and diversions in the less sloping areas are needed to prevent severe erosion from rapid runoff during high intensity rainfall and snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, as much as 20 pounds per acre is applied in spring, summer, or fall.

For dryland hay, suitable grasses grown alone or in combination are alfalfa, intermediate wheatgrass, beardless wheatgrass, hard fescue, tall wheatgrass, and smooth bromegrass (*3*).

The native plant community is dominated by Idaho fescue, bluebunch wheatgrass, and Cusick bluegrass. Sandberg bluegrass and a variety of perennial forbs occur throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, the proportion of Idaho fescue and Cusick bluegrass decreases and the proportion of bluebunch wheatgrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, annual grasses and low value forbs, such as common teasel and bullthistle, predominate.

If the range is in poor condition, seedbed preparation and seeding of the more gently sloping areas to grass are practical. Suitable for dryland seeding are intermediate wheatgrass, hard fescue, pubescent wheatgrass, and alfalfa.

Mule deer use the plant community in summer and late in fall because of the cooler temperatures and proximity to cover. Areas of this soil provide good habitat for small mammals and game birds.

The slope and depth to bedrock are severe limitations for all community and recreation uses, including sanitary facilities and roads. Design modifications are needed.

The capability subclass is IVe.

67E—Waha silt loam, 25 to 40 percent north slopes. This is a moderately deep, well drained soil formed in loess. It is at elevations of 2,800 to 4,300 feet. The average slope is 30 percent. The average annual precipitation is 16 to 20 inches, and the average annual air temperature is 45 to 59 degrees F. The frost free period is 100 to 120 days at 32 degrees and 110 to 150 days at 28 degrees.

In a representative profile the surface layer is black and very dark grayish brown silt loam about 12 inches thick. The subsoil is very dark grayish brown and dark brown silty clay loam about 17 inches thick It is very gravelly in the lower part. Fractured basalt is at a depth of about 29 inches.

About 10 percent of this unit is included areas of Wrentham soils, Rock outcrop, and ash pockets.

Permeability is moderately slow. Available water capacity is 3.5 to 8 inches. Water supplying capacity is 7.5 to 12 inches. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This soil is used for range and wildlife habitat.

The native plant community is dominated by Idaho fescue. Bluebunch wheatgrass and Cusick bluegrass are prominent. Sandberg bluegrass and a variety of perennial forbs occur throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, the proportion of Idaho fescue and Cusick bluegrass decreases and the proportion of bluebunch wheatgrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, annual grasses and low value forbs, such as common teasel and bullthistle, predominate.

If the range is in poor condition, seedbed preparation and seeding of the more gently sloping areas to grass are practical. Suitable for dryland seeding are intermediate wheatgrass, hard fescue, pubescent wheatgrass, and alfalfa.

Mule deer use the plant community in summer and late in fall because of the cooler temperatures and proximity to cover. Areas of this soil provide good habitat for small mammals and game birds.

The slope and depth to bedrock are severe limitations for all community and recreation uses including sanitary facilities and roads. Design modifications are needed.

The capability subclass is VIe.

68D—Waha silt loam, 7 to 25 percent south slopes. This is a moderately deep, well drained soil formed in loess. It is at elevations of 2,800 to 4,300 feet. The average slope is 15 percent. The average annual precipitation is 16 to 20 inches, and the average annual air temperature is 45 to 49 degrees F. The frost free period is 100 to 120 days at 32 degrees and 110 to 150 days at 28 degrees.

In a representative profile the surface layer is black and very dark grayish brown silt loam about 12 inches thick. The subsoil is very dark grayish brown and dark brown silty clay loam about 17 inches thick. It is very gravelly in the lower part. Fractured basalt is at a depth of about 29 inches.

About 5 percent of this unit is included areas of Waterbury and Rockly soils.

Permeability is moderately slow. Available water capacity is 3.5 to 8 inches. Water supplying capacity is 7.5 to 12 inches. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate.

Most of the acreage is used for range and wildlife habitat. Some areas are dryfarmed under a grain-fallow system. The major crop is winter wheat. Barley is commonly grown. The rest of the acreage is used for dryland hay and pasture.

The native vegetation is a plant community dominated by bluebunch wheatgrass. Idaho fescue and Sandberg bluegrass are prominent. A variety of perennial forbs, such as an arrowleaf balsamroot, milkvetch, and yarrow, occurs throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, plant vigor is greatly reduced and the proportion of bluebunch wheatgrass and other desirable grasses decreases. If deterioration is severe, cheatgrass and other low value plants predominate and the hazard of erosion is high.

Seedbed preparation and seeding of the more gently sloping areas are practical if the range is in poor condition. Suitable for dryland seeding are beardless wheatgrass, big bluegrass, crested wheatgrass, and alfalfa.

The plant community is used by Rocky Mountain elk and mule deer in winter and early in spring when other areas are snow covered.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch and minimum tillage along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage is needed to prevent severe erosion from rapid runoff during high intensity rainfall and snowmelt.

In most areas this soil is only 20 inches deep. For this reason, yields are lower than on the other Waha soils.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation and shallow depth. Generally, as much as 20 pounds per acre is applied in spring or fall.

For dryland hay, suitable grasses grown alone or in combination are alfalfa, intermediate wheatgrass, beardless wheatgrass, hard fescue, tall fescue, and smooth bromegrass (*3*).

Areas of this soil provide good habitat for mule deer, small mammals, and game birds.

The slope and depth to bedrock are limitations for all community and recreation uses, including sanitary facilities and roads. Design modifications are needed.

The capability subclass is IVe.

69D—Waha-Rockly complex, 2 to 20 percent slopes. This map unit is on ridgetops at elevations of 3,000 to 4,300 feet. It is 35 percent the shallow Rockly soil formed in wind laid silt, volcanic ash, and basalt colluvium; 50 percent the moderately deep Waha soil formed in loess; 10 percent Waterbury soils; and 5 percent Hankins soils. The Waha and Rockly soils are well drained. Both formed over fractured basalt. This unit occurs as patterned land, locally known as biscuit scabland. The Rockly soil occurs as scabland between and around areas of the Waha soil. If the slope is less than 10 percent, the Waha soil occurs as circular mounds, or biscuits, that have a convex surface and are deepest at the center. If the slope is more than 10 percent, the Waha soil occurs as long mounds, the long axis parallel with the slope. The circular mounds are 20 to 50 feet wide and 20 to 40 feet apart. The long mounds are 100 to 300 feet long and 30 to 60 feet wide.

The average slope is 10 percent. The average annual precipitation is 16 to 20 inches, and the average annual air temperature is 45 to 49 degrees F. The average frost free period is 100 to 120 days at 32 degrees and 110 to 150 at 28 degrees.

In a representative profile of Waha silt loam the surface layer is black and very dark grayish brown and is about 12 inches thick. The subsoil is very dark grayish brown and dark brown silty clay loam about 17 inches thick. It is very gravelly in the lower part. Fractured basalt is at a depth of about 29 inches.

In a representative profile of Rockly very gravelly loam the surface layer is very dark grayish brown and is about 2 inches thick. It is 50 percent rock fragments. The subsoil is very dark grayish brown and dark brown very gravelly loam about 7 inches thick. It is 55 percent rock fragments up to 3 inches in size and about 5 percent fragments 3 inches or larger. Fractured basalt is at a depth of about 9 inches.

The Waha soil has moderately slow permeability. Effective rooting depth is 20 to 40 inches. Available water capacity is 3.5 to 8 inches. Water supplying capacity is 7.5 to 12 inches. Runoff is slow, and the hazard of erosion is slight.

The Rockly soil has moderately slow permeability. Effective rooting depth is restricted by the underlying bedrock at a depth of 5 to 12 inches. Available water capacity is 0.5 to 1.5 inches. Water supplying capacity is 1 to 4 inches. Runoff is slow to medium, and the hazard of erosion is moderate.

Nearly all of the acreage is used for livestock grazing and wildlife habitat.

The major concern in management is maintaining an adequate plant cover for control of water erosion.

On the Waha soil, the native plant community is dominated by Idaho fescue, Sandberg bluegrass, and bluebunch wheatgrass. A variety of perennial forbs occurs throughout the stand. Shrubs are minor. On the Rockly soil, the plant community is dominated by very shallow rooted plants, such as Sandberg bluegrass. Small amounts of Idaho fescue and bluebunch wheatgrass also occur in places. Low growing perennial forbs, such as pussytoes and phlox, are common.

If range condition deteriorates, the proportion of Idaho fescue decreases on the Waha soil and the proportion of bluebunch wheatgrass and Sandberg bluegrass increases. The stand of small bluegrasses decreases and the proportion of low value forbs increases on the Rockly soil. If deterioration is severe, the forage bunchgrasses on the Waha soil and the entire plant community on the Rockly soil are nearly eliminated. As a result, annuals and other less desirable grasses and forbs are prominent on the deeper Waha soil and a barren rock pavement forms on the interspersed Rockly soil.

Because of interspersed areas of the very shallow and stony Rockly soil, range seeding generally is not practical.

Most of the acreage provides food and limited cover for mule deer, small mammals, game birds, and song birds.

The depth to bedrock, the cobbles, and the stones are severe limitations for community and recreation uses on the Rockly soil. Extensive design modifications are needed but in most places are not practical for dwellings, small buildings, and sanitary facilities.

The depth to bedrock and the slope are limitations for community and recreation uses on the Waha soil. Design modifications are needed for dwellings, small buildings, sanitary facilities, and recreation.

The capability subclass is VIIs.

70B—Warden very fine sandy loam, 2 to 5 percent slopes. This is a very deep, well drained soil formed in loess over calcareous lacustrine silt. It is at elevations of 500 to 1,200 feet. The average slope is 4 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 210 days at 28 degrees.

In a representative profile the surface layer is dark brown very fine sandy loam about 5 inches thick. The subsoil is dark brown very fine sandy loam about 15 inches thick. The substratum is calcareous, dark grayish brown silt loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Ritzville and Sagehill soils and 5 percent is Royal and Taunton soils.

Permeability is moderate. Available water capacity is 11 to 12 inches. Water supplying capacity is 6.5 to 9 inches. Effective rooting depth is more than 60 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

Most of the acreage is used for dryfarmed small grain. Where water is available, irrigated crops are grown. Major irrigated crops include potatoes, annual wheat, and alfalfa hay. The rest of the acreage is used for range and wildlife habitat, particularly where the soil occurs within the Boardman Naval Reservation.

Major concerns in management are the hazard of soil blowing, the proper application of irrigation water, and in dryfarmed cropland the conservation of soil moisture. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system under irrigation is a rotation consisting of wheat, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

In many areas, compact, slowly permeable lacustrine silt is at a moderate depth. In overirrigated areas erosion may result from the runoff of excess irrigation water. Proper irrigation rates should be carefully determined in such areas.

The hazard of soil blowing is moderate because of the very fine sandy loam surface layer and the frequent strong winds. Uncontrolled soil blowing causes soil loss. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures needed in controlling soil blowing include winter cover crops, timely irrigation, cultivation, and planting, stubble mulching; minimum tillage; and planting of row crops perpendicular to the wind direction.

In dryfarmed areas, stubble mulch and minimum tillage along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage generally helps in preventing erosion from rapid runoff during high intensity rainfall.

The native plant community is dominated by bluebunch wheatgrass. Sandberg bluegrass is prominent. A few perennial forbs, such as spreading phlox, pussytoes, and western yarrow, are common. Big sagebrush occurs in the stand.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and big sagebrush increases. If deterioration is severe, big sagebrush dominates and much of the surface is left bare under the brush. If fire is the major disturbance, cheatgrass and rubber rabbitbrush dominate the plant community.

If the range is in poor condition, seedbed preparation and seeding are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. After a fire, direct drill seeding without seedbed preparation is a good way of restoring production in a reasonable length of time. Grasses selected for seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested wheatgrass or beardless wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil generally is well suited to community and recreation uses. Playgrounds may require leveling.

The capability subclass is IVe dryland, IIe irrigated.

70C—Warden very fine sandy loam, 5 to 12 percent slopes. This is a very deep, well drained soil formed in wind laid very fine sand over calcareous lacustrine silt. It is on terraces at elevations of 500 to 1,200 feet. The average slope is 8 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost-free period is 140 to 180 days at 32 degrees and 180 to 210 days at 28 degrees.

In a representative profile the surface layer is brown very fine sandy loam about 5 inches thick. The subsoil is brown silt loam about 15 inches thick. The substratum is calcareous brown silt loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Sagehill and Ritzville soils and 5 percent is Royal and Taunton soils.

Permeability is moderate. Available water capacity is 11.5 to 12 inches. Water supplying capacity is 6.5 to 9 inches. Effective rooting depth is 40 to 60 inches. Runoff is medium. The hazard of water erosion is moderate. The hazard of soil blowing is moderate.

Most of the acreage is used for dryfarmed small grain. Where the water is available, irrigated crops are grown. Major irrigated crops include potatoes, annual wheat, and alfalfa hay. The rest of the acreage is used for range and wildlife habitat, particularly where the soil occurs within the Boardman Naval Reservation.

Major concerns in management are the proper application of irrigation water and the conservation of soil moisture in dryfarmed cropland. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

In irrigated areas, a suitable cropping system is a rotation consisting of wheat, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

In many areas, compact, slowly permeable lacustrine silt is at a moderate depth. If these areas are overirrigated, erosion may result from the runoff of excess irrigation water. In such areas proper irrigation rates should be carefully determined.

The hazard of soil blowing is moderate because of the very fine sandy loam surface layer and the frequent strong winds. Uncontrolled soil blowing causes soil loss. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help in controlling soil blowing include winter cover crops; timely irrigation, cultivation, and planting; stubble mulching; minimum tillage; and planting of row crops perpendicular to the wind direction.

In dryfarmed areas, stubble mulch and minimum tillage along with a crop-fallow system minimize erosion and help to maintain soil moisture. Contour tillage generally helps to control erosion from rapid runoff during high intensity rainfall.

The native plant community is dominated by bluebunch wheatgrass. Sandberg bluegrass is prominent. A few perennial forbs, such as spreading phlox, pussytoes, and western yarrow, are common. Big sagebrush occurs in the stand.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and big sagebrush increases. If deterioration is severe, big sagebrush dominates and much of the surface is left bare under the brush. If fire is the major disturbance, cheatgrass and rubber rabbitbrush dominate the plant community.

If the range is in poor condition, seedbed preparation and seeding are practical. Because soil blowing is moderate, seeding to grass presents special problems. After a fire, direct drill seeding without seedbed preparation is a good way of restoring production in a reasonable length of time. Grasses selected for seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested wheatgrass or beardless wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The slope and dust are limitations to community and recreation uses.

The capability subclass is IVe dryland, IIIe irrigated.

70D—Warden very fine sandy loam, 12 to 20 percent slopes. This is a very deep, well drained soil formed in wind laid very fine sand over calcareous lacustrine silt. It is on terraces at elevations of 500 or 1,200 feet. The average slope is 15 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost-free period is 140 to 180 days at 32 degrees and 180 to 210 days at 28 degrees.

In a representative profile the surface layer is brown very fine sandy loam about 5 inches thick. The subsoil is dark brown very fine sandy loam about 15 inches thick. The substratum is calcareous dark grayish brown silt loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Sagehill and Ritzville soils and 5 percent is Royal and Taunton soils.

Permeability is moderate. Available water capacity is 11.5 to 12 inches. Water supplying capacity is 6.5 to 9 inches. Effective rooting depth is 40 to 60 inches. Runoff is medium. The hazard of water erosion is moderate. The hazard of soil blowing is moderate.

Most areas are used for range and wildlife habitat. The rest are used for irrigated crops and dryfarmed small grain.

The native plant community is dominantly bluebunch wheatgrass. Sandberg bluegrass is prominent. A few perennial forbs, such as spreading phlox, pussytoes, and western yarrow, are common. Big sagebrush occurs in the stand.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and big sagebrush increases. If deterioration is severe, big sagebrush dominates and much of the surface is left bare under the brush. If fire is the major disturbance, cheatgrass and rubber rabbitbrush dominate the plant community.

If the range is in poor condition, seedbed preparation and seeding are practical. Because the hazard of soil blowing is moderate, seeding to grass presents special management problems. After a fire, direct drill seeding without seedbed preparation is a good way of restoring production in a reasonable length of time. Grasses selected for seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested wheatgrass or beardless wheatgrass.

Livestock grazing should be limited mainly to winter.

Major concerns in management are the proper application of irrigation water, the hazard of soil blowing, and the conservation of soil moisture in dryfarmed cropland. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system under irrigation is a rotation consisting of wheat, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

In many areas, compact, slowly permeable lacustrine silt is at a moderate depth. If these areas are overirrigated, erosion may result from the runoff of excess irrigation water. Proper irrigation rates should be carefully determined.

Stubble mulch and minimum tillage along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage generally helps to prevent erosion from rapid runoff during high intensity rainfall.

The hazard of soil blowing is moderate because of the very fine sandy loam surface layer and frequent strong winds. Uncontrolled soil blowing causes soil loss. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help in controlling soil blowing include winter cover crops; timely irrigation, cultivation, and planting, stubble mulching; minimum tillage; and planting of row crops perpendicular to the wind direction.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The slope and dust are limitations for community and recreation uses.

The capability subclass is IVe dryland, IVe irrigated.

71A—Warden silt loam, 0 to 2 percent slopes. This is a very deep, well drained soil formed in loess over calcareous lacustrine silt. It is at elevations of 500 to 1,200 feet. The average slope is 1 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 210 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 5 inches thick. The subsoil is brown silt loam about 20 inches thick. The substratum is calcareous, brown silt loam that extends to a depth of 60 inches or more

About 10 percent of this unit is included areas of Ritzville and Sagehill soils and 5 percent is Royal and Taunton soils.

Permeability is moderate. Available water capacity is 11 to 12 inches. Water supplying capacity is 6.5 to 9 inches. Effective rooting depth is more than 60 inches. Runoff is slow, and the hazard of water erosion is slight

Most of the acreage is used for dryfarmed small grain. Where water is available, irrigated crops are grown. Major irrigated crops include potatoes, annual wheat, and alfalfa hay. The rest of the acreage is used for range and wildlife habitat.

Major concerns in management are the proper application of irrigation water and the conservation of soil moisture. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

In irrigated areas, a suitable cropping system is a rotation consisting of wheat, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

In many areas, compact, slowly permeable lacustrine silt is at a moderate depth. If these areas are overirrigated, ponding results. Proper irrigation rates should be carefully determined in such areas.

In dryfarmed areas, stubble mulch and minimum tillage along with a crop-fallow system help to maintain soil moisture.

The native plant community is dominantly bluebunch wheatgrass. Sandberg bluegrass is prominent. A few perennial forbs, such as spreading phlox, pussytoes, and western yarrow, are common. Big sagebrush occurs in the stand.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and big sagebrush increases. If deterioration is severe, big sagebrush dominates and much of the surface is left bare under the brush. If fire is the major disturbance, cheatgrass and rubber rabbitbrush dominate the plant community.

If the range is in poor condition, seedbed preparation and seeding are practical. After a fire, direct drill seeding without seedbed preparation is a good way of restoring production in a reasonable period. Grasses selected for seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested wheatgrass or beardless wheatgrass.

Livestock grazing should be limited to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil is generally well suited to community and recreation uses.

The capability subclass is IVc dryland and class I irrigated.

71B—Warden silt loam, 2 to 5 percent slopes. This is a very deep, well drained soil formed in loess over calcareous lacustrine silt It is on terraces at elevations of 500 to 1,200 feet. The average slope is 3 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 210 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 5 inches thick. The subsoil is brown silt loam about 20 inches thick. The substratum is calcareous, brown silt loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Ritzville and Sagehill soils and 5 percent is Royal and Taunton soils.

Permeability is moderate. Available water capacity is 11 to 12 inches. Water supplying capacity is 6.5 to 9 inches. Effective rooting depth is 40 inches to more than 60 inches. Runoff is slow, and the hazard of water erosion is slight.

Most of the acreage is used for dryfarmed small grain. Where water is available, irrigated crops are grown. Major irrigated crops include potatoes, annual wheat, and alfalfa hay. The rest of the acreage is used for range and wildlife habitat.

Major concerns in management are the proper application of irrigation water and the conservation of soil moisture. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system under irrigation is a rotation consisting of wheat, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

In many areas, compact, slowly permeable lacustrine silt is at a moderate depth. In overirrigated areas soil erosion may result from the runoff of excess irrigation water. Proper irrigation rates should be carefully determined in such areas.

In dryfarmed areas, stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system help to maintain soil moisture. Contour tillage generally helps to prevent erosion from rapid runoff during high intensity rainfall.

Suitable grasses for seeding waterways include pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass.

The native plant community is dominantly bluebunch wheatgrass. Sandberg bluegrass is prominent. A few perennial forbs, such as spreading phlox, pussytoes, and western yarrow, are common. Big sagebrush occurs in the stand.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and big sagebrush increases. If deterioration is severe, big sagebrush dominates and much of the surface is left bare under the brush. If fire is the major disturbance, cheatgrass and rubber rabbitbrush dominate the plant community.

If the range is in poor condition, seedbed preparation and seeding are practical. After a fire, direct drill seeding without seedbed preparation is a good way of restoring production in a reasonable period. Grasses selected for seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested wheatgrass or beardless wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

This soil is generally well suited to community and recreation uses. Playgrounds may require leveling.

The capability subclass is IVe dryland, IIe irrigated.

71C—Warden silt loam, 5 to 12 percent slopes. This is a very deep, well drained soil formed in loess over calcareous lacustrine silt. It is on terraces at elevations of 500 to 1,200 feet. The average slope is 8 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 210 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 5 inches thick. The subsoil is brown silt loam about 20 inches thick. The substratum is calcareous, brown silt loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Ritzville and Sagehill soils and 5 percent is Royal and Taunton soils.

Permeability is moderate. Available water capacity is 11 to 12 inches. Water supplying capacity is 6.5 to 9 inches. Effective rooting depth is 40 inches to more than 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

Most of the acreage is used for dryfarmed small grain. Where water is available, irrigated crops are grown. Major irrigated crops include potatoes, annual wheat, and alfalfa hay. The rest of the acreage is used for range and wildlife habitat.

Major concerns in management are the proper application of irrigation water, the hazard of water erosion, and the conservation of soil moisture. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

In irrigated areas, a suitable cropping system is a rotation consisting of wheat, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

In many areas, compact, slowly permeable lacustrine silt is at a moderate depth. In overirrigated areas soil erosion may result from the runoff of excess irrigation water. Proper irrigation rates should be carefully determined in such areas.

In dryfarmed areas, stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system minimize erosion and help to maintain soil moisture. Contour tillage and stripcropping generally help to control erosion from rapid runoff during high intensity rainfall.

Suitable grasses for waterways include pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass.

The native plant community is dominantly bluebunch wheatgrass. Sandberg bluegrass is prominent. A few perennial forbs, such as spreading phlox, pussytoes, and western yarrow, are common. Big sagebrush occurs in the stand.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and big sagebrush increases. If deterioration is severe, big sagebrush dominates and much of the surface is left bare under the brush. If fire is the major disturbance, cheatgrass and rubber rabbitbrush dominate the plant community.

If the range is in poor condition, seedbed preparation and seeding are practical. After a fire, direct drill seeding without seedbed preparation is a good way of restoring production in a reasonable period. Grasses selected for seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested wheatgrass or beardless wheatgrass.

Livestock grazing should be limited mainly to winter.

Areas of this soil support small populations of mule deer. Birds and small mammals are common.

The slope is a limitation for community and recreation uses.

The capability subclass is IVe dryland, IIIe irrigated.

71D—Warden silt loam, 12 to 20 percent slopes. This is a very deep, well drained soil formed in loess over calcareous lacustrine silt It is on terraces at elevations of 500 to 1,200 feet. The average slope is 15 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 210 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 5 inches thick. The subsoil is brown silt loam about 20 inches thick. The substratum is calcareous, brown silt loam that extends to depth of 60 inches or more.

About 10 percent of this unit is included areas of Ritzville and Sagehill soils and 5 percent is Royal and Gravden soils.

Permeability is moderate. Available water capacity is 11 to 12 inches. Water supplying capacity is 6.5 to 9 inches. Effective rooting depth is 40 inches to more than 60 inches Runoff is medium, and the hazard of water erosion is moderate.

Most of the acreage occurs within the Boardman Naval Reservation. It is used as range and wildlife habitat. Areas outside the reservation are used for irrigated crops and dryfarmed small grain.

The native plant community is dominantly bluebunch wheatgrass. Sandberg bluegrass is prominent. A few perennial forbs, such as spreading phlox, pussytoes, and western yarrow, are common. Big sagebrush occurs in the stand.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and big sagebrush increases. If deterioration is severe, big sagebrush dominates and much of the surface is left bare under the brush. If fire is the major disturbance, cheatgrass and rubber rabbitbrush dominate the plant community.

If the range is in poor condition, seedbed preparation and seeding are practical. After a fire, direct drill seeding without seedbed preparation is a good way of restoring production in a reasonable length of time. Grasses selected for seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested wheatgrass or beardless wheatgrass.

Livestock grazing should be limited mainly to winter.

Major concerns in management are the proper application of irrigation water, the hazard of water erosion, and the conservation of soil moisture Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

In irrigated areas, a suitable cropping system is a rotation consisting of wheat, potatoes, and alfalfa hay. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed and disease control problems are common.

In many areas, compact, slowly permeable lacustrine silt is at a moderate depth. In overirrigated areas soil erosion may result from the runoff of excess irrigation water. Proper irrigation rates should be carefully determined in such areas.

In dryfarmed areas, stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage and stripcropping generally help to prevent erosion from rapid runoff during high intensity rainfall. Suitable grasses for waterways include pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass.

The slope is a limitation for community and recreational uses.

The capability subclass is IVe dryland, IVe irrigated.

71E—Warden silt loam, 20 to 40 percent slopes. This is a very deep, well drained soil formed in loess over calcareous lacustrine silt. It is on terraces at elevations of 500 to 1,200 feet. The average slope is 30 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 210 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 5 inches thick. The subsoil is brown silt loam about 20 inches thick. The substratum is calcarecus, brown silt loam that extends to a depth of 60 inches or more.

About 10 percent of this unit is included areas of Ritzville and Sagehill soils and 5 percent is Royal and Gravden soils.

Permeability is moderate. Available water capacity is 11 to 12 inches. Water supplying capacity is 6.5 to 9 inches. Effective rooting depth is 40 inches to more than 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil is used for range and wildlife habitat.

The native plant community is dominantly bluebunch wheatgrass. Sandberg bluegrass is prominent. A few perennial forbs, such as spreading phlox, pussytoes, and western yarrow, are common. Big sagebrush occurs in the stand.

If the range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and big sagebrush increases. If deterioration is severe, big sagebrush dominates and much of the surface under the brush is left bare. If fire is the major disturbance, cheatgrass and rubber rabbitbrush dominate the plant community.

If the range is in poor condition, seedbed preparation and seeding are practical. After a fire, direct drill seeding without seedbed preparation is a good way of restoring production in a reasonable period. Grasses selected for seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested wheatgrass or beardless wheatgrass.

Livestock grazing should be limited mainly to winter.

This soil supports small populations of mule deer. Birds and mammals are common.

The slope is a limitation for recreation and community uses, including sanitary facilities, dwellings, and buildings.

The capability subclass is VIe dryland.

72C—Warden silt loam, 3 to 12 percent slopes, eroded. This is a very deep, well drained soil formed in loess over calcareous lacustrine silt. It is at elevations of 500 to 1,200 feet. The average slope is 8 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 210 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 1 inch thick. The subsoil is brown silt loam about 20 inches thick. The substratum is calcareous, brown silt loam to a depth of 60 inches or more. In most areas the surface layer and part of the subsoil are eroded and the soil is calcareous to the surface.

About 10 percent of this unit is included areas of Ritzville and Sagehill soils and 5 percent is Royal and Taunton soils.

Permeability is moderate. Available water capacity is 11 to 12 inches. Water supplying capacity is 6.5 to 9 inches. Effective rooting depth is more than 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This soil occurs within the Boardman Naval Reservation. It is used as range and wildlife habitat.

The native plant community has been greatly altered by erosion. Forage production is much lower than in uneroded areas of Warden soils.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and big sagebrush increases. If deterioration is severe, big sagebrush dominates and much of the surface is left bare under the brush. If fire is the major disturbance, cheatgrass and rubber rabbitbrush dominate the plant community.

If the range is in poor condition, seedbed preparation and seeding are practical. After a fire, direct drill seeding without seedbed preparation is a good way of restoring production in a reasonable period. Grasses selected for seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested wheatgrass or beardless wheatgrass.

Livestock grazing should be limited mainly to winter.

This soil supports small populations of mule deer. Birds and small mammals are common.

The slope and dust are limitations for community and recreation uses.

The capability subclass is IVe dryland.

72D—Warden silt loam, 12 to 20 percent slopes, eroded. This is a very deep, well drained soil formed in loess over calcareous lacustrine silt. It is at elevations of 500 to 1,200 feet. The average slope is 15 percent. The average annual precipitation is 8 to 9 inches, and the average annual air temperature is 49 to 53 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 210 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 1 inch thick. The subsoil is brown silt loam about 20 inches thick. The substratum is calcareous, brown silt loam that extends to a depth of 60 inches or more. In most areas the surface layer and part of the subsoil are eroded and the soil is calcareous to the surface.

About 10 percent of this unit is included areas of Ritzville and Sagehill soils and 5 percent is Royal and Taunton soils.

Permeability is moderate. Available water capacity is 11 to 12 inches. Water supplying capacity is 6.5 to 9 inches. Effective rooting depth is more than 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This soil occurs within the Boardman Naval Reservation. It is used for range and wildlife habitat.

The native plant community has been greatly altered by erosion. Forage production is much lower than in uneroded areas of Warden soils.

If range condition deteriorates, the proportion of bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and big sagebrush increases. If deterioration is severe, big sagebrush dominates and much of the surface is left bare under the brush. If fire is the major disturbance, cheatgrass and rubber rabbitbrush dominate the plant community.

If the range is in poor condition, seedbed preparation and seeding are practical considerations. After a fire, direct drill seeding without seedbed preparation is a good way of restoring production in a reasonable period. Grasses selected for seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested wheatgrass or beardless wheatgrass.

Livestock grazing should be limited mainly to winter.

This soil supports small populations of mule deer. Birds and small mammals are common.

The slope and dust are limitations for community and recreation uses.

The capability subclass is VIe dryland.

73E—Waterbury extremely stony silt loam, 7 to 40 percent slopes. This is a shallow, well drained soil formed in weathered basalt colluvium. It is on south- and west-facing slopes at elevations of 2,600 to 4,300 feet. The average slope is about 25 percent. The average annual precipitation is 14 to 20 inches, and the mean annual air temperature is 45 to 49 degrees F. The frost free period is 80 to 110 days at 32 degrees and 110 to 140 days at 28 degrees.

In a representative profile the upper 3 inches of the surface layer is black extremely stony silt loam, and the lower 6 inches is black very cobbly silt loam. The subsoil is black and dark brown very cobbly clay about 8 inches thick. Fractured basalt is at a depth of about 17 inches.

About 15 percent of this unit is included areas of Rockly and Waha soils.

Permeability is very slow. Available water capacity is 1 to 2.5 inches. Water supplying capacity is 6 to 9 inches. Effective rooting depth is 12 to 20 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for livestock grazing and wildlife habitat.

The native vegetation is a plant community dominated by bluebunch wheatgrass. Idaho fescue and Sandberg bluegrass are prominent. A variety of perennial forbs, such as arrowleaf balsamroot, milkvetch, and yarrow, occurs throughout the stand in small amounts. There are few or no shrubs.

If range condition deteriorates, plant vigor is greatly reduced and the proportion of bluebunch wheatgrass and other desirable grasses decreases. If deterioration is severe, cheatgrass and other low value plants predominate and the potential for erosion is high.

Because this soil is stony and shallow, range seeding is not practical.

This plant community is used by Rocky Mountain elk and mule deer in winter and early in spring when other areas are snow covered.

The depth to rock, stones, slope, high clay content, and shrinking and swelling are limitations for community uses. Extensive design modifications are needed but are rarely practical for dwellings, small buildings, and sanitary facilities. The stones, slope, and very slow permeability are limitations for recreation facilities.

The capability subclass is VIIs.

74F—Waterbury-Rock outcrop complex, 40 to 70 percent slopes. This map unit is on south-facing slopes on uplands at elevations of 2,600 to 4,300 feet. It is about 55 percent Waterbury soil, 20 percent Rock outcrop, and 25 percent Waha and Gwin soils and a soil that is similar to this Waterbury soil but is more than 20 inches deep over bedrock. The average slope is about 55 percent. The average annual precipitation is 14 to 20 inches, and the average annual air temperature is 45 to 49 degrees F. The frost free period is 80 to 110 days at 32 degrees and 110 to 140 days at 28 degrees.

In a representative profile of Waterbury soil, the upper 3 inches of the surface layer is black extremely stony silt loam and the lower 6 inches is black very cobbly silt loam. The subsoil is black and dark brown very cobbly clay loam and very cobbly clay about 8 inches thick. Fractured basalt is at a depth of about 17 inches.

Rock outcrop is basalt bedrock.

The Waterbury soil has very slow permeability. Available water capacity is 1 to 2.5 inches. Water supplying capacity is 6 to 9 inches. Effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for livestock grazing and wildlife habitat.

The native vegetation is a plant community dominated by bluebunch wheatgrass. Sandberg bluegrass and Thurber needlegrass are prominent. A variety of perennial forbs and a few shrubs occur in small amounts.

If range condition deteriorates, plant vigor is greatly reduced and the proportion of bluebunch wheatgrass and other desirable grasses decreases. If deterioration is severe, the forage bunchgrasses are nearly eliminated. As a result, low value plants predominate, soils are subject to erosion, and much of the surface is left bare and rocky.

Because the unit is very stony and slopes are steep, range seeding is not practical. At the higher elevations, the plant community is used by Rocky Mountain elk and mule deer in winter and early in spring when other areas are snow covered.

The depth to rock, stones, slope, Rock outcrop, shrinking and swelling, and high clay content are limitations for community developments. Extensive design modifications are needed but are rarely practical for dwellings, small buildings, and sanitary facilities. The stones, slope, and very slow permeability are limitations for recreation facilities.

The capability subclass is VIIs.

75B—Willis silt loam, 2 to 5 percent slopes. This is a moderately deep, well drained soil formed in loess. It is on uplands at elevations of 1,000 to 2,000 feet. The average slope is 4 percent. The average annual precipitation is 9 to 11 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 12 inches thick. The subsoil is brown silt loam about 9 inches thick. The substratum is brown silt loam about 14 inches thick. A calcareous hardpan is at a depth of about 35 inches (fig. 9).

About 5 percent of this unit is included areas of Mikkalo soils and 5 percent is Ritzville soils.

Permeability is moderate. Available water capacity is 4

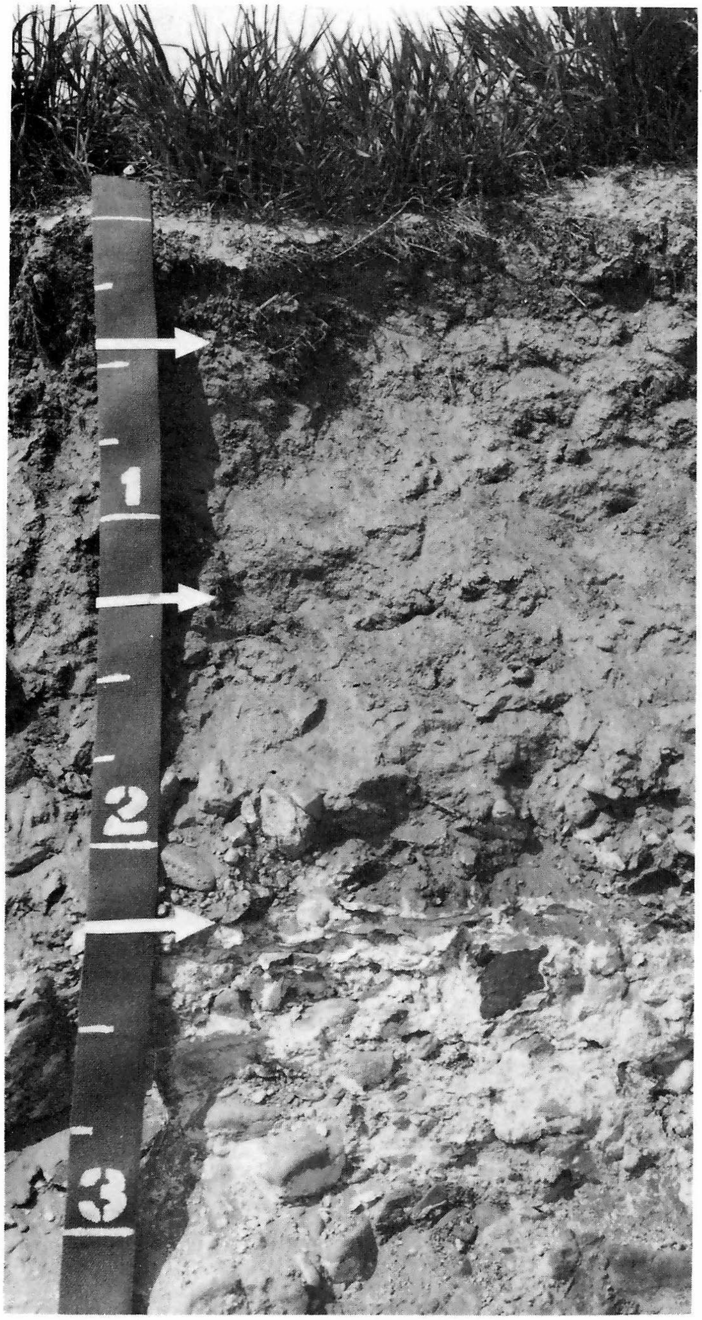


Figure 9.—Profile of Willis silt loam At a depth of 20 to 40 inches is a calcareous indurated hardpan.

to 8.5 inches. Water supplying capacity is 6 to 8 inches. Runoff is slow, and the hazard of erosion is slight. The effective rooting depth is 20 to 40 inches.

Nearly all the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. The rest of the acreage is used for range and wildlife habitat.

The major need in crop management is conserving soil moisture.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Cross-slope tillage in the more level areas and diversions in the steeper areas are desirable, particularly where slopes are long.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass. For dryland hay and pasture, suitable grasses grown alone or in combination are alfalfa, crested wheatgrass, Siberian wheatgrass, beardless wheatgrass, and big bluegrass (*3*).

The native plant community is dominantly bluebunch wheatgrass and Sandberg bluegrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is left bare.

If the range is in poor condition, seedbed preparation and seeding are practical. Suitable for range seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

The cemented pan is a limitation for community uses. Design modifications are needed for dwellings, small buildings, and sanitary facilities. The soil has no serious limitations for recreation facilities. Playgrounds, however, are limited by the cemented pan.

The capability subclass is IVe dryland.

75C—Willis silt loam, 5 to 12 percent slopes. This is a moderately deep, well drained soil formed in loess. It is on uplands at elevations of 1,000 to 2,000 feet. The average slope is 9 percent. The average annual precipitation is 9 to 11 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 12 inches thick. The subsoil is brown silt loam about 9 inches thick. The substratum is brown silt loam about 14 inches thick. A calcareous hardpan is at a depth of about 35 inches.

About 5 percent of this unit is included areas of Mikkalo soils and 5 percent is Ritzville soils.

Permeability is moderate. Available water capacity is 4 to 8.5 inches. Water supplying capacity is 6 to 8 inches. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 20 to 40 inches.

Most of the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. The rest of the acreage is used for range and wildlife habitat.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch, minimum tillage, and grassed waterways along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Cross-slope tillage, contour tillage, and diversions generally are needed to prevent erosion losses during high intensity rainfall or snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

Suitable plants for seeding waterways are pubescent wheatgrass, crested wheatgrass, and streambank wheatgrass. For dryland hay and pasture, suitable grasses grown alone or in combination are alfalfa, crested wheatgrass, Siberian wheatgrass, beardless wheatgrass, and big bluegrass (*3*).

The native plant community is dominated by bluebunch wheatgrass and Sandberg bluegrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is left bare.

If the range is in poor condition, seedbed preparation and seeding are practical. Suitable for range seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

The slope and the cemented pan are limitations for community uses. Modifications in design are needed for dwellings, small buildings, and sanitary facilities. The slope is a limitation for recreation facilities.

The capability subclass is IVe dryland.

75D—Willis silt loam, 12 to 20 percent slopes. This is a moderately deep, well drained soil formed in loess. It is on uplands at elevations of 1,000 to 2,000 feet. The average slope is 15 percent. The average annual precipitation is 9 to 11 inches, and the average annual air temperature is 48 to 51 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 200 days at 28 degrees.

In a representative profile the surface layer is dark brown silt loam about 12 inches thick. The subsoil is brown silt loam about 9 inches thick. The substratum is brown silt loam about 14 inches thick. A calcareous hardpan is at a depth of about 35 inches.

About 5 percent of this unit is included areas of Mikkalo soils and 5 percent is Ritzville soils.

Permeability is moderate. Available water capacity is 4 to 8.5 inches. Water supplying capacity is 6 to 8 inches. Runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is 20 to 40 inches.

About half the acreage is dryfarmed under a grain-fallow system. Wheat is the major crop. Some barley and dryland hay and pasture are grown. The rest of the acreage is used for range and wildlife habitat.

The two major needs in crop management are protecting the soil from water erosion and conserving soil moisture.

Stubble mulch and minimum tillage along with a crop-fallow system minimize erosion loss and help to maintain soil moisture. Contour tillage and diversion help to prevent severe erosion during high intensity rainfall and snowmelt.

Response of wheat and barley to nitrogen fertilizer is low as a result of the low annual precipitation. Generally, 25 pounds per acre of nitrogen fertilizer is applied in spring or fall.

For dryland hay and pasture, suitable grasses grown alone or in combination are alfalfa, crested wheatgrass, Siberian wheatgrass, beardless wheatgrass, and big bluegrass (*3*).

The native plant community is dominantly bluebunch wheatgrass and Sandberg bluegrass. A variety of perennial forbs, such as clustered phlox and western yarrow, occurs throughout the stand. Shrubs are minor.

If range condition deteriorates, bluebunch wheatgrass decreases and the proportion of Sandberg bluegrass and forbs increases. If deterioration is severe, bluebunch wheatgrass is nearly eliminated. As a result, cheatgrass and other low value plants predominate and much of the surface is left bare.

If the range is in poor condition, seedbed preparation and seeding are practical. Suitable for range seeding are big bluegrass, crested wheatgrass, and beardless wheatgrass.

The plant community provides food for mule deer, small mammals, and game birds.

The slope and the cemented pan are limitations for community and most recreation uses. Extensive design modifications are needed for dwellings, small buildings, sanitary facilities, and recreation facilities.

The capability subclass is IVe dryland.

76C—Winchester sand, 0 to 12 percent slopes. This is a very deep, excessively drained soil that formed in mixed sands on terraces. The elevation is 300 to 700 feet. The average slope is 5 percent. The average annual precipitation is 7 to 8 inches, and the average annual air temperature is 52 to 54 degrees F. The frost free period is 160 to 200 days at 32 degrees F. and 180 to 215 days at 28 degrees.

In a representative profile the surface layer is very dark grayish brown sand about 18 inches thick. The substratum is very dark grayish brown and very dark gray coarse sand that extends to a depth of 60 inches or more.

About 15 percent of this unit is included areas of Quincy and Quinton soils and Dune land. Some soils that are similar to Winchester soils but have bedrock at a depth of 40 to 60 inches are included in a few areas.

Permeability is rapid. Available water capacity is 2.5 to 3.5 inches. Water supplying capacity is 2 to 4 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the water erosion hazard is slight. The hazard of soil blowing is high.

Extensive areas are used for irrigated crops, and many more are converted to irrigated cropland every year. A large part of the acreage is used for range and wildlife habitat, particularly where the soil occurs within the Boardman Naval Reservation. Major irrigated crops include potatoes, winter wheat, corn, alfalfa hay, and pasture.

Major concerns in management are the low water capacity and the hazard of soil blowing. Where water is available, irrigation is by sprinklers, most commonly center pivot systems.

A suitable cropping system is a rotation consisting of wheat or corn, potatoes, and alfalfa. If wheat is grown more than 2 consecutive years or if potatoes follow potatoes, serious weed control and disease problems are common.

Because of the coarse texture, low water capacity, and high water consumption, light, frequent applications of irrigation water are needed. Plant nutrients are readily leached from the root zone because of the rapid permeability. Split applications of fertilizer are desirable.

The hazard of soil blowing is one of the highest in the survey area because of the predominance of fine sand in the surface layer and frequent, high winds. Uncontrolled soil blowing causes soil loss and deposition of coarse particles that form drifts, hummocks, and dunes in fields. It also causes crop damage by sandblasting plants, uncovering roots, and uprooting the plants and burying them under the windblown material. Roads are covered, and applied chemicals are lost. Measures that help to control soil blowing include winter cover crops; timely irrigation, cultivation, and planting; minimum tillage; crosswind tillage; and planting of row crops perpendicular to the wind direction. Blowout areas require special treatments, such as disked-in straw mulching and seeding to suitable grasses. Windbreaks, doublecropping, and stripcropping are needed in places. Protection from soil blowing is critical when rangeland is converted to irrigated cropland. Completely developing the irrigation system before any land is broken out, limiting new land disturbance to the period March 15 to September 15, and leaving vegetation intact on odd areas are the practices and precautions needed.

The native plant community is dominantly Indian ricegrass and antelope bitterbrush. Yellow wildrye is prominent on stabilized sand dunes and in other areas of sand movement. Perennial forbs, such as buckwheat and lomatium, are common. Big sagebrush and small green rabbitbrush occur in the plant community.

If range condition deteriorates, the proportion of Indian ricegrass and yellow ryegrass decreases and the proportion of low value forbs and annuals, such as tumblemustard and Russian-thistle, increases. If deterioration is severe, soil blowing is accelerated and sand movement becomes destructive and difficult to control.

If the range is in poor condition, total protection of the existing plant cover is practical. Seedbed preparation and seeding to grass present a special problem because of the critical soil blowing. Suitable for sand dune stabilization is 1-year-old mammoth wildrye.

Livestock grazing should be limited mainly to winter.

This soil supports small populations of mule deer. Birds and small mammals are common.

This soil is generally well suited to community uses. Because of seepage, some design modifications may be needed for sewage lagoons and sanitary landfills. Construction of dwellings, commercial buildings, and roads and streets in the steeper areas is limited somewhat because of the slope. Recreation facilities are limited by the coarse sand texture, and design modifications are needed.

The capability subclass is VIIe dryland, IVs irrigated.

77F—Wrentham-Rock outcrop complex, 35 to 70 percent slopes. This map unit is on north-facing slopes on uplands (fig. 10). It is at elevations of 1,100 to 3,200 feet. It is about 55 percent Wrentham soil; 20 percent Rock outcrop; and 25 percent Nansene and Lickskillet soils, a soil similar to this Wrentham soil but more than 40 inches deep or less than 20 inches deep to bedrock, and a soil similar to the Wrentham soil but calcareous below a depth of 15 to 30 inches. The average slope is about 50 percent. The average annual precipitation is 10 to 16 inches, and the average annual air temperature is 45 to 52 degrees F. The frost free period is 60 to 100 days at 32 degrees and 100 to 150 days at 28 degrees.

In a representative profile of Wrentham soil, the surface layer is black silt loam about 4 inches thick. The subsurface layer is black and very dark brown gravelly silt loam and very cobbly silt loam about 16 inches thick. The subsoil is dark brown very cobbly silt loam about 12 inches thick. Basalt is at a depth of about 32 inches.

Rock outcrop is basalt bedrock.

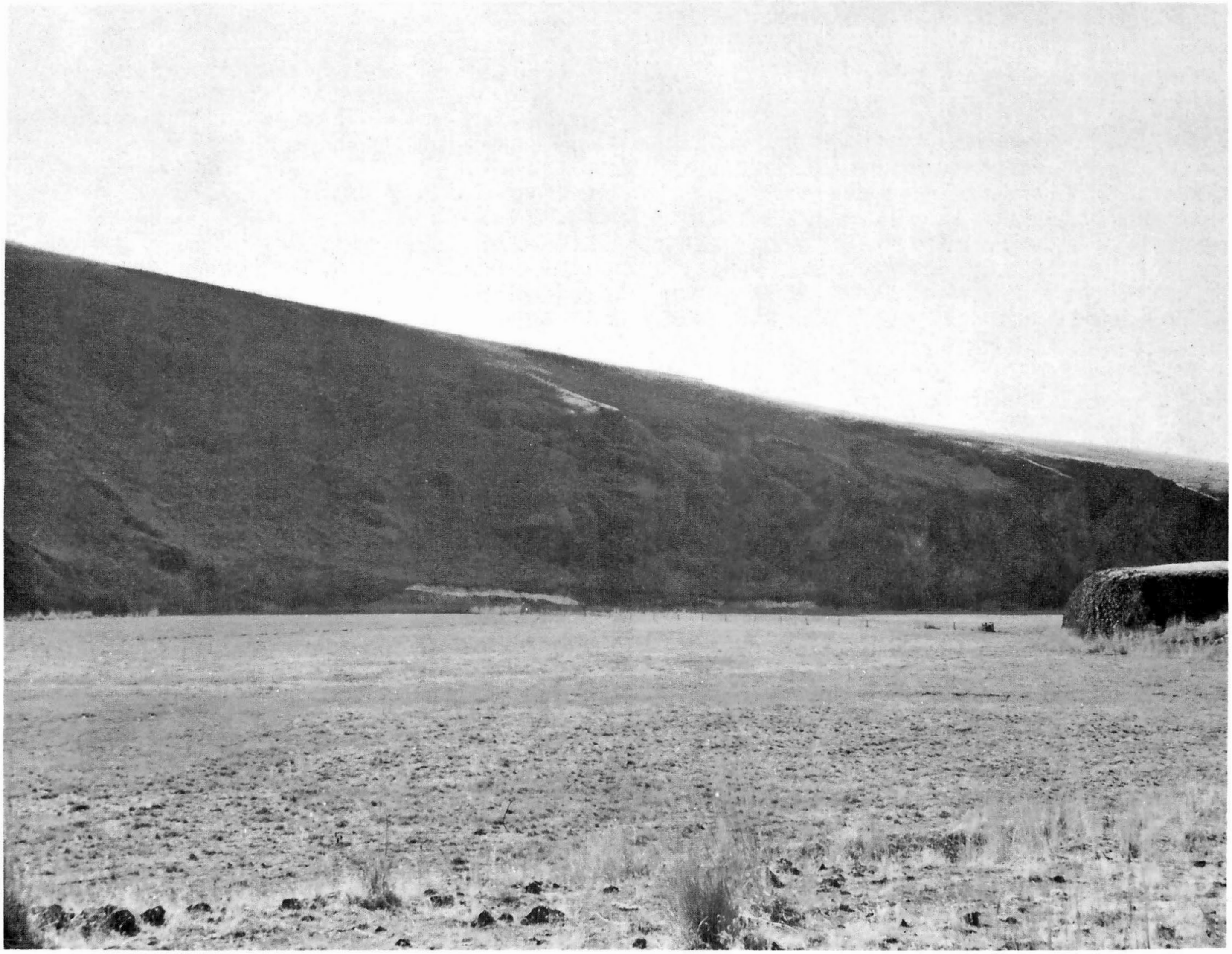


Figure 10—Wrentham-Rock outcrop complex, 35 to 70 percent slopes, in background In the foreground, on the bottom land along Rhea Creek, is an area of Onyx silt loam.

The Wrentham soil has moderately slow permeability. Available water capacity is 2.5 to 7 inches. Water supplying capacity is 6 to 8 inches. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for livestock grazing and wildlife habitat.

The native plant community is dominantly Idaho fescue. Bluebunch wheatgrass and Cusick bluegrass are prominent. Sandberg bluegrass and a wide variety of perennial forbs occur throughout the stand in small amounts. Shrubs are minor.

If range condition deteriorates, the proportion of Idaho fescue and Cusick bluegrass decreases and the proportion of bluebunch wheatgrass increases. If deterioration is severe, the forage bunchgrasses are nearly eliminated or greatly reduced in vigor. As a result, annual grasses and low value forbs are prominent.

Because slopes are steep, range seeding is not practical. Mule deer use this unit in summer and in fall because of the cooler temperatures and proximity to cover.

The shallowness over bedrock, stoniness, Rock outcrop, and very steep slopes are severe limitations for community and recreation uses. Extensive design modifications are needed but are rarely practical for dwellings, small buildings, and sanitary and recreation facilities.

The capability subclass is VIIs.

78—Xeric Torriorthents, nearly level. This map unit consists of very deep, somewhat excessively drained soils formed in water and wind laid materials. It is in canyon bottoms at elevations of 300 to 800 feet. The average slope is 1 percent. The average annual precipitation is about 8 to 9 inches, and the average annual air temperature is about 49 to 53 degrees F. The frost free period is 140 to 180 days at 32 degrees and 180 to 215 days at 28 degrees.

Xeric Torriorthents have a surface layer of dark brown sandy loam about 6 inches thick. The next layer is dark brown fine sandy loam about 9 inches thick. The substratum is 15 inches of dark grayish brown gravelly sandy loam over dark grayish brown very gravelly loamy sand that extends to a depth of 60 inches or more.

About 5 percent of this unit is included areas of Burbank, Koehler, and Ritzville soils; and 10 percent is Quincy, Royal, and Kimberly soils.

Permeability is rapid. Available water capacity and water supplying capacity are variable. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate to high.

Most areas of these soils are used for range and wildlife habitat. Some crops are grown. Hay is the main crop. Some winter wheat is also grown. Alfalfa hay is grown in dryfarmed and irrigated cropland.

The native plant community is needleandthread, bluebunch wheatgrass, and Indian ricegrass. Needleandthread generally is dominant. Sandberg bluegrass is prominent. Perennial forbs, such as Columbia milkvetch and western yarrow, are common. Big sagebrush commonly occurs in small amounts. The soil produces about 800 pounds of forage per acre in favorable years and about 600 pounds per acre in normal years.

If range condition deteriorates, the proportion of forage bunchgrasses decreases and the proportion of Sandberg bluegrass and low value forbs increases. If deterioration is severe as a result of fire or other disturbance, cheatgrass commonly dominates the stand.

If the range is in poor condition, seedbed preparation and seeding dryland grasses are practical. Because the hazard of soil blowing is high, seeding to grass presents special management problems. Grass selected for dryland seeding should have strong seedling vigor and be drought resistant. Suitable for seeding is crested or Siberian wheatgrass.

Livestock grazing should be limited mainly to winter.

These soils provide food and cover for upland game birds, such as ring-necked pheasant and valley quail. Mule deer and smaller mammals use this soil for food and cover.

The major needs in crop management are conserving soil moisture for plant growth and stabilizing streambanks against cutting by water The proper timing and rates of applying irrigation water are important in irrigated areas. Where water is available, irrigation is by sprinklers, most commonly wheelline or handline systems.

A suitable cropping system under irrigation is a rotation consisting of wheat and alfalfa. If wheat is grown more than 2 consecutive years, serious weed and disease control problems are common.

Because of the rapid permeability and high water consumption, light, frequent applications of irrigation water are needed. Split applications of fertilizer are desirable because plant nutrients are leached out of the rooting zone by the irrigation water.

In dryfarmed cropland, stubble mulch and minimum tillage along with a crop-fallow system where wheat is grown minimize erosion and help to conserve soil moisture.

Streambank erosion can be stabilized by maintaining streamside vegetation, especially giant wildrye and riparian shrubs. Such vegetation also serves as important cover.

These soils are on stream flood plains and are subject to flooding. The flooding is a limitation for community developments. The flooding and small stones are limitations for recreation facilities.

The capability subclass is VIe dryland and IIIe irrigated.

Use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Soil maps for detailed planning." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 435,000 acres in the survey area was used for crops and pasture in 1975, according to the Morrow County extension agent and the extension economist from Oregon State University. Of this total, 195,000 acres was in wheat, 30,000 acres of which was irrigated. About 20,200 acres was in potatoes, 21,800 acres in rotation hay and pasture, 10,000 acres in barley, 10,000 acres in other row crops including corn and dry beans, and 4,200 acres in other crops and grain. About 175,000 acres was summer fallowed.

Range covers several thousand acres of irrigable land in the northernmost part of the county. The potential for developing this land depends on the availability of irrigation water and the economics of delivering the water.

Irrigated cropland

Intensive irrigated farming is relatively new in this area. With more experience, farmers are likely to change many of the management and cultural practices.

The most extensively grown crop under irrigation is winter wheat. Wheat is planted in August, September, and early October at a seeding rate of 60 to 100 pounds per acre. If wheat is to be seeded following a potato crop, the vines are left on the soil for erosion control. If wheat follows wheat, the stubble is disked in and wheat is planted in the stubble mulch. Wheat responds well to nitrogen fertilizer, which is applied in soluble form through sprinklers at the rate of 200 to 300 pounds per acre. Wheat is harvested in July and August.

Potatoes usually are planted in February and March at the rate of about 25 bushels per acre. Serious disease problems can develop if they are grown in consecutive years. To reduce the hazard of wind erosion, it is desirable to avoid planting in the same direction as the prevailing wind. In Morrow County, the prevailing wind is from the southwest. If potatoes follow wheat, the stubble is turned under and the field is irrigated to bring up volunteer wheat as a cover crop. The cover crop is turned under when the soil is wet about 4 to 6 weeks before planting time. Minimum tillage or no tillage may be feasible. Either reduces the hazard of wind erosion (*13*).

Deep plowing and a firm seedbed 5 to 7 inches deep are desirable. Potatoes require high levels of nutrients. An adequate amount of potash is essential for starch production. Potatoes respond well to high rates of nitrogen applied in bands at planting time and in soluble form as needed throughout the growing season. Phosphorus may be needed. Under irrigation, potatoes require a uniform supply of soil moisture if they are to form marketable tubers.

Vines are killed about 10 to 14 days before the tubers are machine harvested. This time allows the skins to toughen and reduces bruising during harvest. Vines are killed by chemicals or by mechanical means.

Throughout the growing cycle, weeds are controlled by pre-emergence tilling. As soon as the plants are visible, deep cultivation close to the rows loosens the soil for tuber development. Selective herbicides are also utilized.

Center-pivot irrigation is well adapted to alfalfa hay or pasture. Wheelline and handline systems also are utilized. Hay or pasture follows wheat or potatoes in the crop rotation. Hay or pasture is usually grown 3 to 5 years before it is turned under. In a field of permanent hay or pasture, reseeding every 4 to 6 years is desirable, depending on the variety of alfalfa.

Fall seeding of alfalfa hay or pasture is preferable, especially on sandy soils because they are vulnerable to blowing in spring. Seeding is usually done from August through September. If hay or pasture follows winter wheat, it is desirable to cut and remove the excess stubble and seed the alfalfa directly into the stubble. Volunteer grain can be controlled selectively with herbicides. If alfalfa is to follow a cover crop, the cover crop can be harvested as grass hay, grazed to the ground, or removed by using selective herbicides. Alfalfa can then be drill seeded and irrigated.

To obtain heavy stands and maximum yields, alfalfa should be properly innoculated before seeding. Phosphorus and sulfur may be needed. In the northern part of Morrow County, sulfur and phosphorus are the most limiting nutrients for alfalfa hay production. The rate of application should be based on soil tests.

If the water supply is inadequate, suitable grasses and legumes are alfalfa, birdsfoot trefoil, white clover, intermediate wheatgrass, crested wheatgrass, big bluegrass, pubescent wheatgrass, tall fescue, and tall wheatgrass. If water is adequate and drainage is no problem, suitable legumes and grasses for planting are alfalfa, white clover, orchardgrass, tall fescue, meadow foxtail, smooth bromegrass, tall oatgrass, and big bluegrass (*3*).

Corn for grain and silage and sweet corn are grown under irrigation. The acreage of silage corn is the most extensive. Because of the lack of local processing facilities, only a small acreage is in sweet corn. Most of the sweet corn is trucked to Milton-Freewater for processing.

Corn is planted in May or June. In sandy soils, planting at this time has the advantage of good weather conditions and quicker ground cover. Also, windspeed is lower than in March and April. Corn can be seeded into the wheat stubble and irrigated to induce germination and plant emergence. It can also be seeded into a cover crop, after the cover crop is cut for hay, or grazed, or removed with herbicides. Minimum tillage and selective weed control can be adapted to corn. Planting perpendicular to the prevailing wind direction reduces soil blowing.

Corn responds to applications of nitrogen, phosphorus, and potassium. Mixed fertilizer is applied as bands beside the corn row during planting. Later, nitrogen can be added through the irrigation water.

Currently watermelons are raised only in the Irrigon area in northern Morrow County, but there is potential for melon production throughout the northern part of the county. Protecting the soil from blowing is important in melon production. In the seedling stage, airborne soil particles can be highly destructive to tender plant tissue. Grain windbreaks reduce the hazards of soil blowing and vine erosion and trap warmth for earlier melons. For cereal windbreaks the field can be seeded to grain in the fall. In winter, alternate strips 5 feet wide are rototilled and compacted to prepare a seedbed for the melons. Late in June, the grain windbreaks are undercut and left slumped over for protection from wind.

Some sorghum is raised, mainly for erosion control. Sorghum not only provides a protective ground cover but also protects the soil after harvest because it has a dense root system. Sorghum for erosion control is planted on corners between circle systems or as a cover crop on newly broken cropland. The potential of sorghum for other uses, primarily as feed sorghum, remains to be determined.

A small acreage is used for other crops that can be grown under irrigation. Asparagus, dry beans, green beans, mint, soybeans, and sugar beets are examples.

South of the irrigated part of Morrow County, irrigation water is not generally available and crops are dryfarmed. An exception is on bottom lands along the major streams where water is available and wheel or handline systems are used. Alfalfa hay and pasture are the main crops on this bottom land. They are grown permanently or are rotated with wheat. Management needs are the same as those previously mentioned.

Nonirrigated cropland

Winter wheat is the major dryland crop. Because of the lack of sufficient precipitation, wheat is cultivated in a grain-fallow system. In this system fields are alternated for wheat production. A field is used for wheat one year and left idle—void of all vegetation—the following year, allowing the moisture supply to build up for the following wheat crop. Land to be fallowed is usually tilled early in spring of the year after the previous crop harvest. The stubble is left intact throughout the winter to help retain snow and rain as well as to reduce the risk of wind and water erosion (fig. 11). Fall tilling of stubble provides better weed control but can adversely affect stored soil moisture, especially during a dry spring.

Winter wheat is usually seeded in October or November. Sometimes it is seeded in spring for weed control. Sometimes reseeding in spring is needed because of insufficient moisture for seed germination in the fall or because of loss of the stand as a result of winterkill from freezing or frost heaving. Normal seeding rates for winter wheat are 45 to 60 pounds per acre.

Winter wheat responds to nitrogen fertilizer. The time and rate of fertilizer application depend on adequate soil moisture, precipitation, and soil depth. Inadequate precipitation is the main factor affecting wheat yields in Morrow County.

Weeds are controlled through the use of selective herbicides and the use of rod weeders on fallowed soils. Insects are controlled by aerial spraying of insecticides.

Erosion, one of the main problems on dryland soils, can be reduced through the use of proper residue management, contour stripcropping, stubble mulch tillage, chisel plowing perpendicular to the slope, grassed waterways, and diversions laid out at proper intervals on the slope (fig. 12).

Barley is an alternative dryland crop. If planted on south-facing slopes, which are drier and warmer, barley will usually yield higher than winter wheat. Winter-hardy spring varieties are often seeded in the fall. These varieties, however, are not so hardy or vigorous as wheat. They sometimes freeze out and have to be reseeded in spring. Barley also is not so effective for erosion control as winter wheat because its straw breaks down more rapidly.

Another practical consideration is to reseed marginal cropland to a permanent mixed stand of alfalfa and grass, which protects the soil from erosion and provides grazing for livestock.

Some alfalfa hay and pasture is raised under dryland management, but yields are low. In areas where precipitation is less than 12 inches, moisture is insufficient for dryland hay production (*3*). The alfalfa seed must be properly innoculated. Hay should be reseeded every 8 to 15 years, depending on the variety.

Yields per acre

The average yields per acre that can be expected of

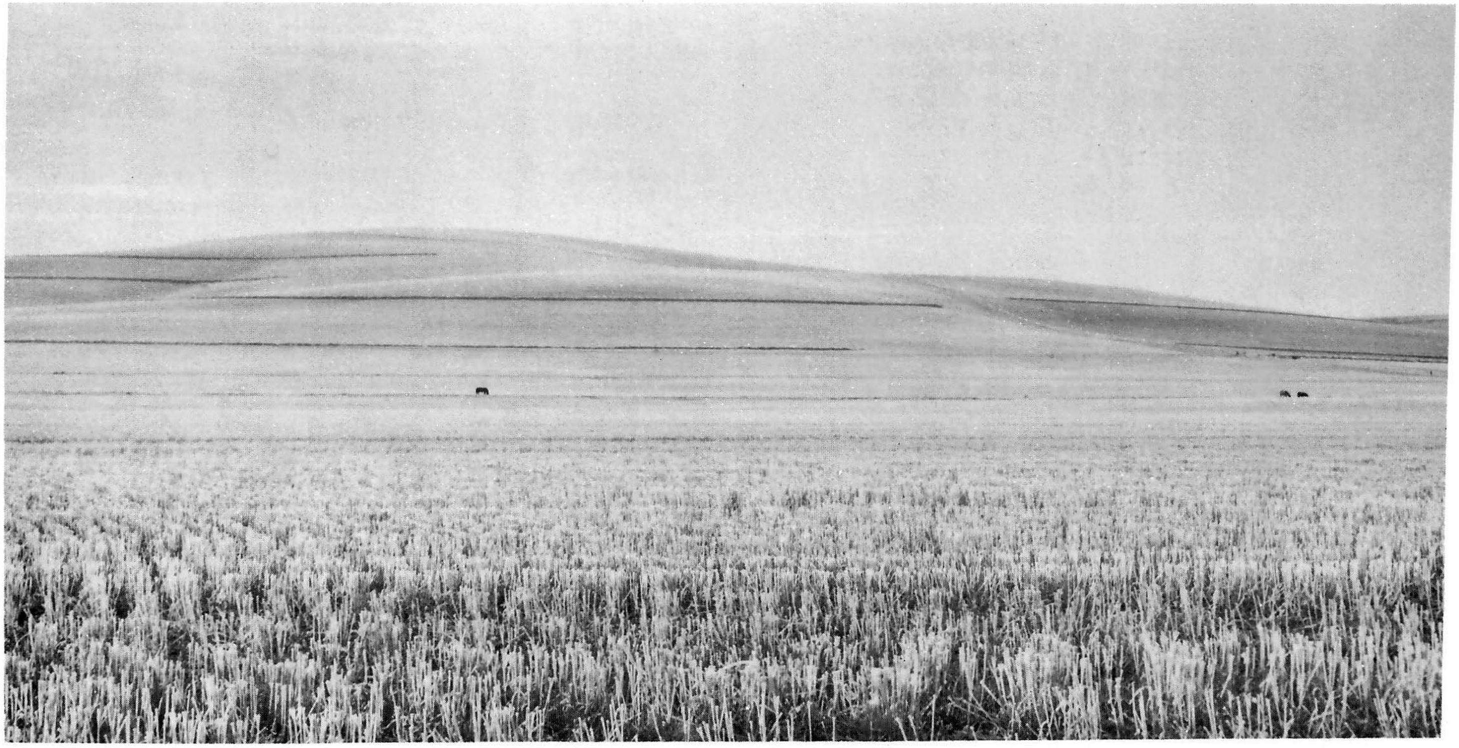


Figure 11.—Wheat stubble on Morrow soils, in winter, reduces the hazard of water erosion

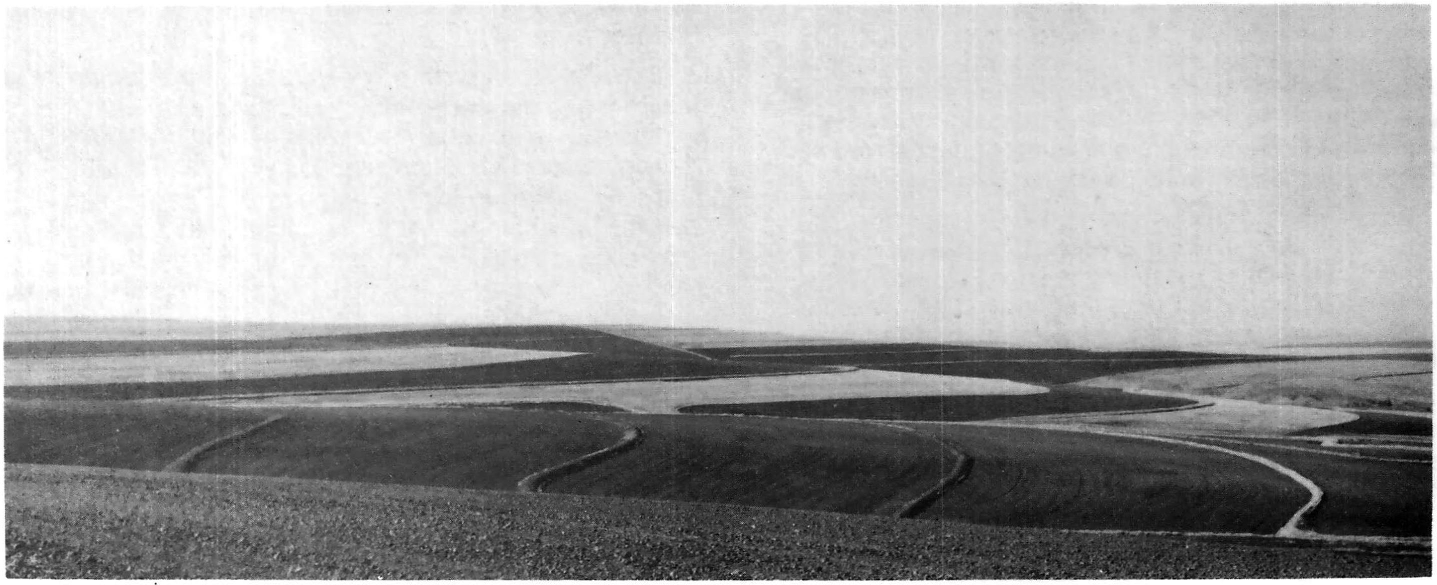


Figure 12—Moisture control on dryfarmed Morrow soils. Diversion terraces dissect summer fallowed areas in the foreground. In the distance, alternate wheat stubble and summer fallowed areas form contour stripcropping.

the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

Land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped (*11*) according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use. There are no class V soils in the survey area.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Rangeland

Samuel F Greenfield, area range conservationist, Soil Conservation Service, helped prepare this section

Approximately 536,000 acres, or 45 percent, of the Morrow County soil survey area is rangeland. Conifer forests along the southern fringe of the county make up about 19 percent of the total acreage. This area of approximately 254,000 acres provides important summer grazing for livestock.

Range in Morrow County is truly grassland. Bluebunch wheatgrass, Idaho fescue, and Sandberg bluegrass make up nearly 90 percent of the potential native vegetation. Broadleaf herbs and shrubs are insignificant as forage plants.

Natural plant communities that represent the grazing potential of the survey area are common because in many areas used for a wheat-summer fallow cropping system, cultivation is deferred every other year. Productivity of the range can be maintained, or in many areas improved, by using management that is effective for specific kinds of soil and plant communities.

On most livestock ranches, the forage produced is supplemented by wheat stubble and crop residue. In the northern third of the county, near the Columbia River, winter is the best season of use. In this area precipitation falls mostly as rain and temperatures are fairly mild. Because of the frequent strong west winds, wind erosion can be severe in spring. Protecting the area from grazing during the growing season should be considered.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to differences in the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for each soil in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture. Plant species that have special value for livestock forage are mentioned in the description of each map unit.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Woodland management and productivity

In the paragraphs that follow is information on the relationship between soils and trees. Interpretations are given that are useful to landowners and operators in planning, establishing, and managing wood crops.

Forest covers about 254,000 acres, or 19 percent, of the survey area. About 160,000 acres, or 65 percent, is within the Umatilla National Forest owned by the Federal Government. The other 94,000 acres, or 35 percent, is owned by private individuals and forest industry.

The principal forest types include inland Douglas-fir, ponderosa pine, western larch, grand fir, lodgepole pine, and western juniper.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Woodland understory vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

Table 8 shows, for each soil suitable for woodland use, the potential for producing understory vegetation. The total production of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4 1/2 feet. It is expressed in pounds per acre of air-dry vegetation in favorable, normal, and unfavorable years. In a favorable year, soil moisture is above average during the optimum part of the growing season; in a normal year, soil moisture is average; and in an unfavorable year, it is below average.

Table 8 also lists the common names of the characteristic vegetation on each soil and the percentage composition, by air-dry weight, of each kind of plant. The table shows the kind and percentage of understory plants expected under a canopy density that is most nearly typical of woodland in which the production of wood crops is highest.

Windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building site development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill, sand, gravel, and topsoil. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. The ratings in table 12 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 12.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water management

Table 13 gives information on the soil properties and site features that affect water management. The kinds of soil limitations are given for pond reservoir areas and embankments, dikes, and levees.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Recreation

The soils of the survey area are rated in table 14 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 14, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 14 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 15, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and balsamroot.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include valley and mountain quail, pheasant, meadowlark, field sparrow, cottontail, and coyote.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, grouse, thrushes, woodpeckers, squirrels, coyote, raccoon, badger, deer, bear, and elk.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include mule deer, chukar, Hungarian partridge, meadowlark, valley quail, hawks, golden eagles, and owls.

Soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil Pertinent soil and water features also are given.

Engineering properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and chemical properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 17, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and water features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either rippable or hard. If the rock is rippable or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Cemented pans are hard subsurface layers, within a depth of 5 or 6 feet, that are strongly compacted (indurated). Such pans cause difficulty in excavation. The hardness of pans is similar to that of bedrock. A rippable pan can be excavated, but a hard pan generally requires blasting.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*12*) Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Xeroll (*xer*, meaning dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haploxerolls (*Hapl*, meaning minimal horizonation, plus *xeroll*, the suborder of Mollisols that have a xeric moisture regime).

SUBGROUP. Each great group has a typic subgroup Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Lithic* identifies the subgroup that typifies the great group except that it has a lithic contact within 20 inches of the surface. An example is Lithic Haploxerolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is loamy-skeletal, mixed, mesic, Lithic Haploxerolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series. An example is the Lickskillet series.

Soil series and morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*10*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*12*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series

The map units of each soil series are described in the section "Soil maps for detailed planning."

Aquepts

Aquepts are very deep, poorly drained soils formed in volcanic ash and recent alluvium. They are in mountain meadows in the Blue Mountains. The slope is 0 to 3 percent. The mean annual precipitation is about 24 inches, and the mean annual air temperature is about 43 degrees F.

Pedon of Aquepts, nearly level, 50 feet north of road, Brown Prairie SE1/4SW1/4SE1/4 sec. 23, T. 5 S , R. 28 E.

A11—0 to 11 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slighty plastic; many medium and fine roots; many very fine pores; slightly acid (pH 6.2); clear wavy boundary.

IIA12—11 to 15 inches; very dark brown (10YR 2/2) silt loam, gray (10YR 5/1) dry; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine pores; few fine distinct yellowish brown (10YR 5/6) mottles; slightly acid (pH 6.2); abrupt smooth boundary.

IIC1—15 to 23 inches; grayish brown (10YR 5/2) silt loam, white (10YR 8/1) dry; massive; hard, firm, nonsticky and nonplastic; many very fine pores; few roots; few distinct yellowish brown (10YR 5/6) mottles; fine black concretions; mildly alkaline (pH 7.4); smooth wavy boundary.

IIC2—23 to 27 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; brittle; few roots; many very fine pores; common medium yellowish brown (10YR 5/6) mottles; mildly alkaline (pH 7.4); abrupt smooth boundary.

IIIB2t—27 to 32 inches; dark brown (10YR 3/3) silty clay loam, grayish brown (10YR 5/2) dry; weak medium prismatic structure parting to moderate medium and coarse subangular blocky; slightly hard, friable, sticky and plastic; few roots; many very fine pores; medium nearly continuous clay films; 15 percent coarse sand (pumice); neutral (pH 7.0); abrupt smooth boundary.

IVA1b—32 to 44 inches; black (N 2/0) silty clay, very dark gray (10YR 3/1) dry; moderate medium prismatic structure; hard, friable, very sticky and very plastic; few roots; many very fine pores; neutral (pH 7.0); abrupt smooth boundary.

IVC1—44 to 51 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light gray (2.5Y 7/2) dry; massive; hard, friable, sticky and plastic; many very fine pores; neutral (pH 7.0); clear wavy boundary.

IVC2—51 to 60 inches; dark greenish gray (5GY 4/1) silty clay loam, light gray (5Y 7/2) dry; massive; hard, friable, sticky and plastic; many very fine pores; neutral (pH 7.0).

Depth to sandy loam, very gravelly sandy loam, very cobbly loam, or bedrock is 25 to 60 inches.

The A horizon has value of 2 or 3 moist, 3 through 5 dry, and chroma of 0 or 1 moist and dry. It contains layers that are more than 60 percent volcanic ash and more than 5 inches thick.

The IIA12 horizon has value of 2 or 3 moist, 4 or 5 dry, and chroma of 1 or 2 moist and dry. It is commonly mottled, particularly in the lower part.

The IIIB2t horizon has hue of 10YR to 2.5Y. In places it is mottled. Mottles are few to many and faint to prominent. In many pedons the lower part of this horizon is gleyed. This horizon is 30 to 60 percent clay. It ranges from silty clay loam to clay.

The IVC horizon is gleyed and in places is mottled. It ranges from loam to clay. Hue is 2.5Y, 5Y, or 5GY.

In spring, the water table is at the surface in some areas.

Aquolls

Aquolls are very deep, poorly drained soils formed in loess, alluvium, and small amounts of volcanic ash. They are in mountain meadows and along drainageways in the Blue Mountains. The slope is 0 to 5 percent. The mean annual precipitation is about 25 inches, and the mean annual air temperature is about 44 degrees F.

Pedon of Aquolls, nearly level, 150 feet from road, sec. 12, T. 6 S., R. 25 E.

A1—0 to 3 inches; black (2.5Y 2/0) silt loam, very dark gray (10YR 3/1) dry; strong fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; neutral (pH 6.6); abrupt smooth boundary.

B2—3 to 19 inches; black (2 5Y 2/0) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine pores; neutral (pH 6.8); clear smooth boundary.

B31—19 to 33 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many very fine pores; common medium distinct mottles; neutral (pH 7.1); clear smooth boundary.

B32—33 to 38 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many very fine pores; common medium distinct mottles; neutral (pH 7.0); clear smooth boundary.

IIC1—38 to 47 inches; very dark gray (10YR 3/1) silty clay, grayish brown (10YR 5/2) dry; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; many very fine pores; common medium prominent mottles; slightly acid (pH 6.4); clear smooth boundary.

IIC2—47 to 60 inches; very dark grayish brown (10YR 3/2) silty clay, brown (10YR 5/3) dry; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; many very fine pores; many medium prominent mottles; slightly acid (pH 6.4).

The A horizon has value of 2 or 3 moist, 3 or 4 dry, and chroma of 0 or 1 moist and dry.

The B2 horizon is silt loam or silty clay loam. It has value of 2 or 3 moist, 3 or 4 dry, and chroma of 0 or 1 moist and dry.

The B3 horizon has moist value of 2 or 3 in the upper part and 3 or 4 in the lower part. Dry value is 4 or 5. Chroma is 1 or 2 moist and dry. Mottles are few to many and faint to prominent.

The IIC horizon is silty clay, clay loam, or sandy loam. Hue is 10YR, 2.5Y, or 5GY. Value is 3 through 5 moist, 5 or 6 dry. Chroma is 1 or 2 moist and 2 or 3 dry. In places this horizon is gleyed. Mottles range from few to many and from faint to distinct. The content of pebbles and cobbles ranges from 0 to 60 percent.

Bakeoven series

The Bakeoven series consists of shallow, well drained soils formed in loess and in residuum from basalt rock. These soils are on ridgetops and breaks into canyons. Slopes are 2 to 20 percent. The mean annual precipitation is about 13 inches, and the mean annual air temperature is about 50 degrees F.

Typical pedon of Bakeoven very cobbly loam, 2 to 20 percent slopes, 200 feet north of Highway 206, NW1/4SW1/4NW1/4 sec. 30, T. 3 S., R. 26 E.

A1—0 to 2 inches; dark brown (7.5YR 3/3) very cobbly loam, brown (7.5YR 5/3) dry; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; 25 percent pebbles; 30 percent cobbles; 5 percent stones; neutral (pH 6.6); clear wavy boundary.

B2—2 to 7 inches; dark brown (7.5YR 3/3) extremely cobbly loam, brown (7.5YR 4/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; 30 percent pebbles; 40 percent cobbles; neutral (pH 6.6); abrupt wavy boundary.

IIR—7 inches; basalt.

The solum is 35 to 75 percent coarse fragments. Depth to bedrock is 5 to 12 inches. Hue is 7.5YR or 10YR.

The A horizon has chroma of 2 or 3 moist and hue of 7.5YR or 10YR. The B horizon has chroma mainly of 2 or 3 moist and dry. In places the chroma is 4 in the lower part.

Boardtree series

The Boardtree series consists of very deep, well drained soils formed in ashy material over clayey sediment. These soils are on north-facing slopes in the Blue Mountains. The gradient is 7 to 40 percent. The mean annual precipitation is about 23 inches, and the mean annual air temperature is about 43 degrees F.

Typical pedon of Boardtree loam, 7 to 40 percent slopes, 100 feet south of road in SW1/4SW1/4SW1/4 sec. 24, T. 5 S., R. 26 E.

O1—1 inch to 0; fir needles and twigs.

A1—0 to 1 inch; dark brown (7.5YR 3/2) loam, pinkish gray (7.5YR 6/2) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common roots; many irregular pores; neutral (pH 6.8); gradual smooth boundary.

B21—1 inch to 14 inches; brown (7.5YR 4/2) loam, pinkish gray (7.5YR 7/2) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common roots; many irregular pores; neutral (pH 6.8); gradual smooth boundary.

IIB22—14 to 25 inches; brown (7.5YR 4/4) loam, pinkish gray (7.5YR 6/2) dry, weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common roots; many irregular pores; 5 percent pebbles; slightly acid (pH 6.4); abrupt wavy boundary.

IIIB21tb—25 to 40 inches; brown (10YR 4/3) clay, brown (10YR 5/3) dry; weak medium subangular blocky structure; very hard, very firm, very sticky and very plastic; common roots; many tubular pores; 5 percent pebbles; neutral (pH 6.6); gradual wavy boundary.

IIIB22tb—40 to 50 inches; brown (10YR 4/3) clay loam, brown (10YR 5/3) dry; massive; hard, firm, sticky and plastic; common roots; many tubular pores; moderately thick clay films in pores; 5 percent pebbles; neutral (pH 6.8); gradual wavy boundary.

IIIC—50 to 60 inches; brown (7.5YR 5/4) clay loam, light brown (7.5YR 6/4) dry; massive; slightly hard, friable, sticky and plastic; few roots; many tubular pores; moderately thick clay films in pores; 5 percent pebbles; neutral (pH 7.0).

Depth to partly consolidated bedrock is more than 60 inches. Depth to the clayey layer ranges from 20 to 40 inches.

The A horizon has value of 3 or 4 moist and 5 or 6 dry and chroma of 1 or 2 moist and dry.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5 moist and 6 or 7 dry, and chroma of 2 through 4 moist and dry. It is loam or silt loam that is 10 to 20 percent clay.

The IIIB2tb horizon has hue of 10YR or 7.5YR, value of 3 or 4 moist and 5 or 6 dry, and chroma of 3 or 4 moist and dry. It is clay, silty clay, heavy clay loam, or silty clay loam that is more than 35 percent clay.

The IIIC horizon has hue of 10YR or 7.5YR, value of 4 or 5 moist and 6 or 7 dry, and chroma of 2 through 4 moist and dry. It is loam, clay loam, or silt loam that is 10 to 20 percent clay In places it has pockets of clayey material.

Bocker series

The Bocker series consists of very shallow, well drained soils formed in loess and in residuum from basalt. These soils are on ridgetops. The slope is 2 to 12 percent. The mean annual precipitation is 25 inches, and the mean annual air temperature is 44 degrees F.

Typical pedon of Bocker extremely cobbly silt loam, 2 to 12 percent slopes, NW1/4SE1/4SW1/4 sec. 9, T. 6 S., R. 28 E.

A11—0 to 2 inches; dark reddish brown (5YR 3/3) extremely cobbly silt loam, reddish brown (5YR 5/4) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; 30 percent cobbles; 30 percent pebbles; 10 percent stones; neutral (pH 6.8); clear smooth boundary.

A12—2 to 8 inches; dark reddish brown (5YR 3/3) extremely cobbly silt loam, reddish brown (5YR 5/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; 30 percent cobbles; 30 percent pebbles; 10 percent stones; neutral (pH 6.8); abrupt wavy boundary.

R—8 inches; basalt.

The thickness of the mollic epipedon and depth to bedrock range from 4 to 10 inches. The solum ranges from 35 to 70 percent cobbles, pebbles, and stones. Hue is 10YR, 7.5YR, or 5YR. Chroma is 2 or 3 moist.

Burbank series

The Burbank series consists of very deep, excessively drained soils formed in gravelly alluvial deposits and wind worked material. These soils are on terraces. Slopes are 2 to 12 percent. The mean annual precipitation is about 8 inches, and the mean annual air temperature is about 53 degrees F.

Typical pedon of Burbank loamy fine sand, 2 to 5 percent slopes, 100 feet west of the Patterson Ferry Road in SE1/4NE1/4SE1/4 sec. 16, T. 5 N., R. 26 E.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; single grained; loose, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; neutral (pH 6.6); clear abrupt boundary.

C1—5 to 20 inches; dark brown (10YR 4/3) loamy fine sand, brown (10YR 5/3) dry; single grained; loose, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; neutral (pH 6.6); clear wavy boundary.

IIC2—20 to 34 inches; dark brown (10YR 4/3) very cobbly loamy fine sand, brown (10YR 5/3) dry; massive; soft, friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; 50 percent cobbles; 10 percent pebbles; neutral (pH 6.8); clear wavy boundary.

IIC3—34 to 60 inches; very cobbly sand; gravel, cobbles, and coarse sand intermittently weakly coated with lime.

Depth to very gravelly and very cobbly sand is 20 to 40 inches. The 10- to 40-inch control section is 45 to 75 percent coarse fragments.

This soil has value of 5 or 6 dry and 3 or 4 moist and chroma of 2 or 3 moist and dry. The 10- to 40-inch control section is dominantly very gravelly loamy sand or very gravelly loamy fine sand.

Ellum series

The Ellum series consists of moderately deep, well drained soils formed in water deposited sand and gravel. These soils are on terraces. Slopes are 2 to 12 percent. The mean annual precipitation is about 8 inches, and the mean annual air temperature is about 53 degrees F.

Typical pedon of Ellum fine sandy loam, 2 to 5 percent slopes, 30 feet east of road, SW1/4SW1/4NW1/4 sec. 27, T. 3 N., R. 26 E.

A1—0 to 5 inches; dark brown (10YR 3/3) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; mildly alkaline (pH 7.6); clear smooth boundary.

C1—5 to 13 inches; dark brown (10YR 4/3) fine sandy loam, light brownish gray (10YR 6/2) dry; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; mildly alkaline (pH 7.6); clear wavy boundary.

IIC2—13 to 23 inches; dark brown (10YR 4/3) very gravelly fine sandy loam, pale brown (10YR 6/3) dry; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; 60 percent pebbles; mildly alkaline (pH 7.6); clear wavy boundary.

IIC3ca—23 to 28 inches; dark brown (10YR 4/3) extremely gravelly fine sandy loam, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; 60 percent pebbles; 5 percent cobbles; moderately calcareous; pebbles and cobbles coated with lime; moderately alkaline (pH 8.0); abrupt wavy boundary.

IIIC4casim—28 to 36 inches; very gravelly duripan; massive; strongly cemented, very firm, very hard; silica and lime coatings on undersides of pebbles; root mat on surface of pan.

Depth to the calcareous, gravelly duripan is 20 to 40 inches. The pan ranges from weakly cemented to strongly cemented. Depth to lime is 10 to 24 inches.

The A horizon has chroma of 2 or 3 moist and dry.

The C horizon has value of 6 dry and 4 moist and chroma of 2 or 3 moist and dry. The C1 horizon ranges from fine sandy loam to gravelly fine sandy loam, the IIC2 horizon is very gravelly fine sandy loam or very gravelly sandy loam, and the IIC3ca horizon is extremely gravelly fine sandy loam or extremely gravelly sandy loam.

Endersby series

The Endersby series consists of very deep, somewhat excessively drained soils formed in alluvium from loess and volcanic ash. These soils are on alluvial bottom lands. Slopes are 0 to 3 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 50 degrees F.

Typical pedon of Endersby fine sandy loam, at the mouth of Rhea Creek where it enters Willow Creek, along Highway 74, SW1/4SE1/4NW1/4 sec. 12, T. 1 S, R. 24 E.

Ap—0 to 6 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, friable, nonsticky and nonplastic, many very fine roots; many very fine irregular pores; mildly alkaline (pH 7.4); abrupt smooth boundary.

A12—6 to 12 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine and fine tubular pores; mildly alkaline (pH 7.4); many wormcasts; clear smooth boundary

C1—12 to 21 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine and fine tubular pores; mildly alkaline (pH 7.4); many wormcasts; abrupt smooth boundary.

C2—21 to 36 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry, massive; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine and common fine tubular pores; mildly alkaline (pH 7.4), clear wavy boundary.

Ab—36 to 60 inches; black (10YR 2/1) heavy silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline (pH 7.4).

Depth to gravel or partly consolidated bedrock is more than 60 inches. The mollic epipedon ranges from 20 to 38 inches in thickness.

The A horizon has value of 4 or 5 dry and chroma of 2 or 3 moist and dry.

The C horizon has value of 4 through 6 dry and 3 or 4 moist. Values of 5 or 6 dry and 3 or 4 moist are at a depth of more than 20 inches. The horizon is mainly loam or fine sandy loam. The lower part is stratified silt to loamy sand in places.

Esquatzel series

The Esquatzel series consists of very deep, well drained soils formed in alluvium from loess and volcanic ash. These soils are on alluvial bottom lands. Slopes are 0 to 3 percent. The mean annual precipitation is about 10 inches, and the mean annual air temperature is about 52 degrees F.

Typical pedon of Esquatzel silt loam, 210 feet north of farm road past barn, SW1/4SE1/4SE1/4 sec. 14, T. 2 N., R. 23 E.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure parting to weak fine platy; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and common medium and large roots; many very fine irregular pores; neutral (pH 7.0); abrupt smooth boundary.

A12—5 to 17 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; neutral (pH 7.2); clear wavy boundary.

B2—17 to 25 inches; dark brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; weak medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; weakly calcareous; mildly alkaline (pH 7.4); clear wavy boundary.

C1ca—25 to 41 inches; dark brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular pores; strongly calcareous; moderately alkaline (pH 8.0); clear wavy boundary.

C2ca—41 to 60 inches; dark brown (10YR 3/3) coarse silt loam, pale brown (10YR 6/3) dry; massive; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common very fine tubular pores; few firm calcareous nodules one-eighth to one-half inch in diameter; strongly calcareous; moderately alkaline (pH 8.2).

Depth to secondary carbonates is 12 to 40 inches. The mollic epipedon is 10 to 20 inches thick.

The A1 horizon has chroma of 2 or 3 moist and dry. The C horizon has value of 5 or 6 dry and chroma of 2 or 3 moist and dry. It is silt loam, but thin lenses of fine sandy loam are below the control section in places.

Gravden series

The Gravden series consists of shallow, well drained soils formed in wind laid material mixed with gravelly alluvium and colluvium. Slopes are 5 to 40 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 52 degrees F.

Typical pedon of Gravden very gravelly loam, 5 to 20 percent slopes, about 55 feet south of a farm road, NE1/4NE1/4SW1/4 sec. 19, T. 2 N., R. 27 E.

A11—0 to 3 inches; dark brown (10YR 3/3) very gravelly loam, pale brown (10YR 6/3) dry; weak fine to medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 25 percent pebbles; 10 percent cobbles; moderately alkaline (pH 8.0); clear wavy boundary.

A12—3 to 7 inches; dark brown (10YR 3/3) very gravelly loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 30 percent gravel; 10 percent cobbles; one-eighth inch lime coatings on undersides of gravel; moderately alkaline (pH 8.0); clear wavy boundary.

Clca—7 to 14 inches; brown (10YR 4/3) extremely gravelly loam, light yellowish brown (10YR 6/4) dry; massive; soft, very friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; 55 percent gravel; 10 percent cobbles; gravel lime coated on all surfaces; one-eighth to one-fourth inch lime coatings on underside of gravel; moderately calcareous; moderately alkaline (pH 8.2); clear irregular boundary.

IIC2casim—14 to 20 inches; very gravelly duripan; massive; strongly cemented, very hard, very firm; 1- to 2-millimeter silica laminar capping on surface; strongly calcareous; root mat on pan surface.

IIC3sim—20 to 60 inches; similar to IIC2casim but stratified and strongly and weakly cemented.

Depth to the duripan is 10 to 20 inches. The pan is weakly cemented to strongly cemented, and it is 35 to 50 percent pebbles.

The A horizon has value of 3 or 4 moist and chroma of 2 or 3 moist and dry. The C horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 3 or 4 moist and dry. It is very gravelly or extremely gravelly loam that is 50 to 80 percent pebbles.

Gwin series

The Gwin series consists of shallow, well drained soils formed in loess and volcanic ash and in residuum and colluvium from basalt. These soils have south-facing slopes. The gradient is 12 to 70 percent. The mean annual precipitation is about 21 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Gwin extremely stony silt loam, 12 to 40 percent slopes, NE1/4SE1/4SE1/4 sec. 15, T. 6 S., R. 27 E.

A11—0 to 3 inches; very dark brown (7.5YR 2/2) extremely stony silt loam, dark brown (7.5YR 4/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; 35 percent pebbles; 20 percent cobbles and stones; neutral (pH 6.6); clear smooth boundary.

B1t—3 to 9 inches; very dark brown (7.5YR 2/2) very cobbly silt loam, dark brown (7.5YR 4/3) dry; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; many very fine tubular pores; 15 percent pebbles; 30 percent cobbles and stones; neutral (pH 6.6); clear wavy boundary.

B2t—9 to 15 inches; dark brown (7.5YR 3/2) extremely cobbly clay loam, brown (7.5YR 4/3) dry; moderate and fine subangular blocky structure; slightly hard, friable, sticky and plastic; common roots; common very fine tubular pores; few thin clay films; 70 percent pebbles and cobbles; neutral (pH 6.6); abrupt irregular boundary.

R—15 inches; basalt.

Depth to basalt bedrock is 10 to 20 inches. The control section is 50 to 80 percent pebbles, cobbles, and stones.

The A horizon has hue of 10YR or 7.5YR. The B2t horizon has hue of 10YR or 7.5YR, value of 2 or 3 moist and 4 or 5 dry, and chroma of 2 or 3 moist and dry. It is silty clay loam or clay loam that is very cobbly or extremely cobbly.

Hall Ranch series

The Hall Ranch series consists of moderately deep, well drained soils formed in mixed volcanic ash, loess, and colluvium from andesite and rhyolite. These soils are in the Blue Mountains. Slopes are 2 to 30 percent. The mean annual precipitation is about 23 inches, and the mean annual air temperature is about 44 degrees F

Typical pedon of Hall Ranch loam, 2 to 12 percent slopes, SE1/4NE1/4NE1/4 sec. 22, T. 6 S., R. 29 E.

O1—1 inch to 0; Douglas-fir and ponderosa pine needles and twigs.

A11—0 to 3 inches; dark reddish brown (5YR 2/2) loam, dark reddish gray (5YR 4/2) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots, many very fine tubular pores; 5 percent pebbles; slightly acid (pH 6.4); clear smooth boundary.

A12—3 to 7 inches; dark reddish brown (5YR 3/2) loam, dark reddish gray (5YR 4/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine tubular pores; 5 percent pebbles; slightly acid (pH 6.4); gradual smooth boundary.

B21—7 to 17 inches, dark reddish brown (5YR 3/3) loam, reddish brown (5YR 5/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine tubular pores; 5 percent pebbles; neutral (pH 6 6); gradual smooth boundary.

B22—17 to 23 inches; dark reddish brown (5YR 3/4) loam, reddish brown (5YR 5/4) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine tubular pores; 5 percent pebbles; neutral (pH 6.6); abrupt smooth boundary.

Cr—23 to 27 inches; partly weathered andesite.

The solum ranges from 5 to 35 percent rock fragments. Depth to soft andesite or rhyolitelike rock ranges from 20 to 40 inches.

The A horizon has value of 2 or 3 moist and 4 or 5 dry, chroma of 2 or 3 moist and dry, and hue of 10YR, 7.5YR, or 5YR. It is loam or gravelly loam.

The B horizon has value of 3 or 4 moist and 5 or 6 dry, chroma of 2 through 4 moist and dry, and hue of 10YR, 7.5YR, or 5YR. It is loam or gravelly loam that is 18 to 27 percent clay.

Hankins series

The Hankins series consists of very deep, well drained soils formed in colluvium from volcanic ash and fine textured sediment. These soils are on south-facing slopes in the Blue Mountains. The gradient is 5 to 35 percent. The mean annual precipitation is about 21 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Hankins silt loam, 5 to 30 percent south slopes, in roadcut above Wilson Creek Road, about 3 miles east of junction with Rhea Creek Road, SW1/4NW1/4SW1/4 sec 25, T. 4 S., R. 27 E.

O1—1 inch to 0; pine needles and twigs.

A11—0 to 6 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate very fine and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; many irregular pores; neutral (pH 6.6); clear wavy boundary.

A12—6 to 12 inches; very dark grayish brown (10YR 3/2) heavy silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; many irregular pores; 2 percent pebbles; neutral (pH 6.6); abrupt wavy boundary.

IIB2t—12 to 27 inches; dark brown (10YR 3/3) clay, brown (10YR 5/3) dry; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky and blocky; very hard, very firm, very sticky and very plastic; common roots; 2 percent pebbles; 2 percent cobbles; common moderately thick clay films; slightly acid (pH 6.4); clear wavy boundary.

IIB31t—27 to 37 inches; yellowish brown (10YR 5/4) clay, light yellowish brown (10YR 6/4) dry; moderate medium and coarse subangular blocky and blocky structure; extremely hard, very firm, very sticky and very plastic; common roots; few tubular pores; 2 percent pebbles; 5 percent cobbles; common moderately thick patchy clay films; neutral (pH 7.0); clear wavy boundary.

IIB32t—37 to 47 inches; yellowish brown (10YR 5/4) clay, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky and blocky structure; very hard, very firm, very sticky and very plastic; few roots; few tubular pores; 2 percent pebbles; 5 percent cobbles; common moderately thick clay films; mildly alkaline (pH 7.4); abrupt wavy boundary.

IIC1—47 to 56 inches; yellowish brown (10YR 5/6) clay loam, brownish yellow (10YR 6/6) dry; massive; hard, friable, sticky and plastic; few roots; few pores; 2 percent pebbles; 5 percent cobbles; slightly calcareous in spots; mildly alkaline (pH 7.4); abrupt wavy boundary.

IIC2—56 to 60 inches; light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/6) clay loam, very pale brown (10YR 7/3) and yellow (10YR 7/6) dry; massive; hard, friable, sticky and plastic; few roots; few tubular pores; 2 percent pebbles; 5 percent cobbles; mildly alkaline (pH 7.6).

The solum contains few to 15 percent rock fragments. Depth to semiconsolidated water laid sediment is more than 60 inches. The mollic epipedon ranges from 15 to 30 inches in thickness.

The A horizon has value of 2 or 3 moist and 3 through 5 dry and chroma of 1 through 3 moist and dry.

The upper part of the Bt horizon has moist value of 3 or 4, and the lower part has moist value of 4 or 5. Dry value is 4 through 6. Chroma is 2 through 4 moist and dry. This horizon is clay that is 45 to 60 percent clay. Hue is 10YR or 7.5YR.

The C horizon has value of 4 or 5 moist and 5 or 6 dry and chroma of 2 through 6 moist and dry. It ranges from heavy silty clay loam to clay.

Helter series

The Helter series consists of deep, well drained soils formed in volcanic ash and loess. These soils are on plateaus and north-facing slopes. The gradient is 3 to 60 percent. The mean annual precipitation is about 25 inches, and the mean annual air temperature is about 42 degrees F.

Typical pedon of Helter silt loam, bedrock substratum, 3 to 15 percent slopes, NE1/4NW1/4SE1/4 sec. 4, T. 5 S., R. 28 E.

O1—1 inch to 0; litter and duff composed of needles, leaves, wood fragments, and moss.

A1—0 to 3 inches; dark grayish brown (10YR 3/2) silt loam, light brown (10YR 6/3) dry; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many roots; neutral (pH 6.6); clear wavy boundary.

B21—3 to 13 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/3) dry; weak fine blocky structure; soft, very friable, nonsticky and nonplastic; many roots; neutral (pH 6.6); clear wavy boundary.

B22—13 to 26 inches; light yellowish brown (10YR 7/4) silt loam, very pale brown (10YR 8/3) dry; massive; slightly hard, very friable, nonsticky and nonplastic; common roots; neutral (pH 6.8); abrupt smooth boundary.

IIB21b—26 to 37 inches; dark yellowish brown (10YR 4/4) loam, pale brown (10YR 6/3) dry; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few roots; 5 percent pebbles; neutral (pH 6.8); clear wavy boundary.

IIB22b—37 to 55 inches; yellowish brown (10YR 5/4) very gravelly loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few roots; 35 percent pebbles; 5 percent cobbles; neutral (pH 6.8); abrupt wavy boundary.

R—55 inches; andesite.

Depth to bedrock is 40 to 60 inches. The ash is 20 to 40 inches thick over the buried soil.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4 moist and 5 or 6 dry, and chroma of 2 or 3 moist and dry.

The B2 horizon has value of 4 to 7 moist and 7 or 8 dry and chroma of 3 to 6 moist and dry. It has weak structure or is massive. The IIB2b horizon has hue of 10YR or 7.5YR, value of 3 to 5 moist and 5 or 6 dry, and chroma of 3 or 4 moist and dry. It is loam, silt loam, or silty clay loam in the upper part and is very gravelly loam below 37 inches.

Hezel series

The Hezel series consists of very deep, somewhat excessively drained soils formed in water and wind laid material. These soils are on terraces and uplands. Slope gradient ranges from 2 to 12 percent. The mean annual precipitation is about 8 inches, and the mean annual air temperature is about 52 degrees F.

Typical pedon of Hezel loamy fine sand, 2 to 5 percent slopes, 300 feet south of the canal and farm road, SW1/4NE1/4NW1/4 sec. 22, T. 4 N., R. 25 E.

A1—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; single grained; soft, friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; neutral (pH 7.2); clear smooth boundary.

C1—9 to 24 inches; dark brown (10YR 3/3) loamy fine sand, pale brown (10YR 6/3) dry; massive; loose, friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; neutral (pH 7.3); clear smooth boundary.

C2ca—24 to 30 inches; dark brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; massive; loose, friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; slightly calcareous; mildly alkaline (pH 7.8); abrupt wavy boundary.

IIC3ca—30 to 51 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium platy structure; hard, firm, slightly sticky and slightly plastic; common to few very fine roots; few very fine tubular pores; strongly calcareous hard laminated silt loam; common horizontal and vertical lens of fine sand and fine sandy loam; moderately alkaline (pH 8.4); abrupt smooth boundary.

IIC4ca—51 to 62 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) silt loam, light gray (10YR 7/2) dry; moderate medium platy structure, very hard, firm, slightly sticky and slightly plastic; few very fine tubular pores; common horizontal and vertical lens of fine sand and fine sandy loam; strongly calcareous; moderately alkaline (pH 8.4); clear wavy boundary.

Depth to lacustrine material is 15 to 36 inches. Depth to secondary lime is 10 to 30 inches.

The A horizon is single grained or has weak subangular blocky structure.

The C1 horizon has value of 3 or 4 moist and 5 or 6 dry and chroma of 2 or 3 moist and dry. The Cca horizon has value of 3 through 5 moist and 6 or 7 dry and chroma of 2 or 3 moist and dry. It is silt loam, fine sand, or fine sandy loam and is stratified. This horizon is moderately alkaline or strongly alkaline.

Irrigon series

The Irrigon series consists of moderately deep, well drained soils formed in alluvial sand derived from basalt and quartzite. These soils are on terraces. Slopes are 2 to 12 percent. The mean annual precipitation is about 8 inches, and the mean annual air temperature is about 53 degrees F.

Typical pedon of Irrigon fine sandy loam, 2 to 5 percent slopes, NE1/4NW1/4SW1/4 sec. 15, T. 3 N., R. 26 E.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; neutral (pH 6.6); abrupt smooth boundary.

B21—3 to 18 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak coarse prismatic structure; slightly hard, very friable, slightly plastic and slightly sticky; common very fine roots; many very fine tubular pores; neutral (pH 6.6); clear wavy boundary.

B22—18 to 23 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; neutral (pH 6.6); abrupt wavy boundary.

IIR—23 inches; semiconsolidated tuffaceous sandstone.

The profile is noncalcareous throughout. Depth to sandstone is 20 to 40 inches. The solum is up to 5 percent pebbles and 5 percent cobbles.

The A horizon has chroma of 2 or 3 moist and dry. The B2 horizon has value of 5 or 6 dry and 3 or 4 moist. It is fine sandy loam or loam.

Kimberly series

The Kimberly series consists of very deep, well drained soils formed in mixed loess, silty alluvium, and volcanic ash. These soils are on alluvial bottom lands. Slopes are 0 to 3 percent. The mean annual precipitation is about 10 inches, and the mean annual air temperature is about 52 degrees F.

Typical pedon of Kimberly fine sandy loam, one-half mile north of Cecil, SE1/4SE1/4NE1/4 sec. 29, T. 2 N., R. 23 E.

Ap—0 to 4 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak fine platy to weak fine granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; neutral (pH 7.0); abrupt smooth boundary.

A12—4 to 15 inches; very dark grayish brown (10YR 3/2) fine sandy loam, brown (10YR 5/3) dry; weak fine to medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine tubular pores; neutral (pH 7.0); gradual smooth boundary.

B22—15 to 23 inches; dark brown (10YR 3/3) fine sandy loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine tubular pores; neutral (pH 7.3); clear wavy boundary.

B3—23 to 33 inches; brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine tubular pores; moderately calcareous, mildly alkaline (pH 7.8); abrupt wavy boundary.

Cca—33 to 40 inches; brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; massive; hard, firm, nonsticky and nonplastic; common very fine roots; many very fine tubular pores; moderately calcareous; 15 percent one-half inch nodules; moderately alkaline (pH 8.0); abrupt discontinuous boundary.

C3—40 to 60 inches; dark grayish brown (10YR 4/2) sandy loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine tubular pores; moderately calcareous; moderately alkaline (pH 8.2).

Depth to bedrock is more than 60 inches. Depth to secondary lime is 10 to 30 inches. The mollic epipedon is 10 to 20 inches thick.

The A horizon has value of 2 or 3 moist and 4 or 5 dry and chroma of 2 or 3 moist and dry. The B horizon has value of 3 or 4 moist and 4 through 6 dry and chroma of 2 or 3 moist and dry. The C horizon has value of 3 or 4 moist and 5 or 6 dry and chroma of 2 or 3 moist and dry.

Klicker series

The Klicker series consists of moderately deep, well drained soils formed in wind laid silt and volcanic ash mixed with basalt colluvium. These soils are in the Blue Mountains. Slopes are 2 to 75 percent. The mean annual precipitation is about 24 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Klicker stony silt loam, 2 to 20 percent slopes, near Fire Road no. 20, NE1/4NW1/4SE1/4 sec. 27, T. 6 S., R. 26 E.

A11—0 to 4 inches; dark reddish brown (5YR 2/3) stony silt loam, reddish brown (5YR 4/3) dry; weak very fine and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many roots; 15 percent cobbles and stones; 10 percent pebbles; neutral (pH 6.6); clear smooth boundary.
A12—4 to 11 inches; dark reddish brown (5YR 3/3) cobbly silt loam, reddish brown (5YR 4/3) dry; weak very fine and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many roots; many very fine tubular pores; 35 percent pebbles, cobbles, and stones; neutral (pH 6.6); clear wavy boundary.
B2t—11 to 19 inches; dark reddish brown (5YR 3/4) very cobbly silty clay loam, dark brown (7.5YR 4/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common roots; few very fine tubular pores; 50 percent pebbles and cobbles; common thin clay films, especially on rock fragments; slightly acid (pH 6.4); clear wavy boundary.
B3—19 to 26 inches; dark brown (7.5YR 4/3) very cobbly silty clay loam, dark brown (7.5YR 4/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common roots; 70 percent pebbles and cobbles; slightly acid (pH 6.4); abrupt irregular boundary.
R—26 inches; fractured basalt.

The weighted average of rock fragments in the 10- to 40-inch control section ranges from 35 to 60 percent. Depth to bedrock ranges from 20 to 40 inches. Hue ranges from 5YR to 10YR.

The A1 horizon has value of 2 or 3 moist and 4 or 5 dry and chroma of 2 or 3 moist or dry.

The B2t horizon has value of 3 or 4 moist and dry and chroma of 2 to 4 moist and dry. It is dominantly silty clay loam but ranges to silt loam that is about 35 to 50 percent angular gravel, cobbles, or stones.

Koehler series

The Koehler series consists of moderately deep, excessively drained soils formed in mixed sand. These soils are on terraces Slopes are 2 to 12 percent. The mean annual precipitation is about 8 inches, and the mean annual air temperature is about 53 degrees F.

Typical pedon of Koehler loamy fine sand, 2 to 5 percent slopes, 300 feet east of a gravel road, SE1/4NW1/4SE1/4 sec. 22, T. 4 N., R. 24 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) loamy fine sand, brown (10YR 5/3) dry; single grained; very soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; 3 percent pan fragments 2 to 10 millimeters in diameter; mildly alkaline (pH 7.6); gradual wavy boundary.
C1—4 to 15 inches; dark brown (10YR 3/3) loamy fine sand, pale brown (10YR 6/3) dry; single grained; very soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; 3 percent pan fragments 2 to 10 millimeters in diameter; mildly alkaline (pH 7.8); gradual wavy boundary.
C2ca—15 to 24 inches; brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; single grained; soft, friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; moderately calcareous; 5 percent pan fragments 2 to 10 millimeters in diameter; moderately alkaline (pH 8.4); abrupt wavy boundary.
IIC3ca—24 to 28 inches; dark grayish brown (10YR 4/2) loamy fine sand, light brownish gray (10YR 6/2) dry; massive; soft, friable, nonsticky and nonplastic; few very fine roots; few very fine irregular pores; moderately calcareous; 50 percent pan fragments 2 to 10 millimeters in diameter, 20 percent pan fragments more than 3 inches in diameter; moderately alkaline (pH 8.4); gradual wavy boundary.
IIC4casim—28 inches; light gray (10YR 7/2) duripan, white (10YR 8/1) dry.

Depth to the duripan is 20 to 40 inches.

The A1 horizon has value of 5 or 6 dry and 3 or 4 moist.

The C and Cca horizons have value of 6 through 8 dry and 3 through 5 moist. These horizons are loamy sand, loamy fine sand, or fine sand. Thin sandy loam lenses are immediately above the duripan in some places.

Labuck series

The Labuck series consists of moderately deep, well drained soils that formed in colluvium and residuum from granodiorite. These soils are in the Blue Mountains. The slope is south facing. The gradient is 5 to 35 percent. The mean annual precipitation is about 22 inches, and mean annual air temperature is about 44 degrees F.

Typical pedon of Labuck loam, 5 to 35 percent slopes, 50 feet north of road, SE1/4SE1/4NE1/4 sec. 9, T. 4 S., R. 29 E.

O1—1 inch to 0; pine needles and twigs.

A1—0 to 6 inches; dark brown (10YR 4/3) loam, light brownish gray (10YR 6/2) dry; weak fine granular and weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine tubular pores; 10 percent pebbles 2 to 5 millimeters in diameter; slightly acid (pH 6.4); gradual wavy boundary.

B21—6 to 14 inches; yellowish brown (10YR 5/4) loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine tubular pores; 10 percent pebbles 2 to 5 millimeters in diameter; slightly acid (pH 6.2); gradual wavy boundary.

B22—14 to 21 inches; yellowish brown (10YR 5/4) gravelly loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine irregular pores; 20 percent pebbles 2 to 5 millimeters in diameter; medium acid (pH 6.0); gradual wavy boundary.

C1—21 to 31 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam, yellowish brown (10YR 5/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; few roots; many very fine pores, 35 percent pebbles; medium acid (pH 6.0); abrupt wavy boundary.

C2r—31 inches; yellowish brown (10YR 5/4) partly decomposed granodiorite, light yellowish brown (10YR 6/4) dry.

Depth to paralithic contact is 20 to 40 inches. Hue is 10YR to 7.5YR.

The A horizon has value of 3 or 4 moist, 5 or 6 dry, and chroma of 2 or 3 moist and dry. It has weak granular or subangular blocky structure. It is 5 to 15 percent rock fragments.

The B22 horizon has value of 3 through 5 moist, 6 or 7 dry, and chroma of 2 through 4 moist and dry. It is 15 to 35 percent rock fragments.

The C horizon has value of 4 or 5 moist, 5 through 7 dry, and chroma of 2 through 4 moist or dry. The content of rock fragments in the C horizon is 15 to 35 percent.

Lickskillet series

The Lickskillet series consists of shallow, well drained soils formed in shallow, stony colluvium from loess and in residuum from basalt. These soils are on west- and south-facing slopes of canyon and river breaks. The gradient is 7 to 70 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 49 degrees F.

Typical pedon of Lickskillet very stony loam, 7 to 40 percent slopes, about 300 feet north of Highway 206, SE1/4SE1/4SW1/4 sec. 26, T. 3 S., R. 24 E.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) very stony loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; about 35 percent cobbles; 20 percent pebbles; 5 percent stones; neutral (pH 6.8); clear wavy boundary.

B21—2 to 8 inches; dark brown (10YR 3/3) extremely cobbly heavy loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; about 35 percent pebbles; 30 percent cobbles; 5 percent stones; neutral (pH 6.8); gradual wavy boundary.

B22—8 to 17 inches; dark brown (10YR 3/3) extremely cobbly heavy loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; about 35 percent cobbles; 35 percent pebbles; neutral (pH 6.8); abrupt wavy boundary.

IIR—17 inches; fractured basalt.

Depth to bedrock is 12 to 20 inches. In some places the A1 horizon is as little as 5 percent rock fragments, but the B2 horizon ranges from 40 to 85 percent. The mollic epipedon ranges from 10 to 19 inches in thickness. Hue is 10YR or 7.5YR.

The A horizon has value of 2 or 3 moist and chroma of 2 or 3 moist and dry. The B2 horizon mainly has the same value as that of the A horizon, but in the lower part of some thicker pedons, the value is 4 and the chroma is 3 or 4 moist and dry. This horizon is heavy loam or clay loam that is very cobbly or extremely cobbly.

Mikkalo series

The Mikkalo series consists of moderately deep, well drained soils formed in wind laid materials. These soils are on uplands. Slopes are 2 to 20 percent. The mean annual precipitation is about 10 inches, and the mean annual air temperature is about 49 degrees F.

Typical pedon of Mikkalo silt loam, 7 to 12 percent slopes, 100 feet east of Ione-Gooseberry Road, NE1/4NW1/4NW1/4 sec. 29, T. 1 S., R. 24 E.

Ap—0 to 6 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine to very fine subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many very fine tubular pores; neutral (pH 7.4); gradual smooth boundary.

A3—6 to 13 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine to medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; mildly alkaline (pH 7.6); gradual smooth boundary.

B2—13 to 24 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak moderate prismatic and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; mildly alkaline (pH 7.8); clear smooth boundary.

B3—24 to 30 inches; pale brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine to medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; moderately calcareous; moderately alkaline (pH 8.4); abrupt smooth boundary.

C1ca—30 to 35 inches; pale brown (10YR 6/3) silt loam, light gray (10YR 7/2) dry; massive; hard, very firm, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; 15 percent coarse fragments 2 to 10 millimeters in diameter; strongly calcareous; moderately alkaline (pH 8.4); abrupt wavy boundary.

IIR—35 inches; lime coated basalt.

Depth to bedrock is 20 to 40 inches. The mollic epipedon is 7 to 15 inches thick. The control section is silt loam that is 8 to 12 percent clay and less than 15 percent material coarser textured than very fine sand.

The Ap horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3 moist and dry.

The B2 horizon has value of 5 or 6 dry and 3 or 4 moist and chroma of 3 or 4 moist and dry. The B3 horizon has value of 6 or 7 dry and 4 or 5 moist and chroma of 2 or 3 moist and dry.

The Cca horizon has value of 7 or 8 dry and 4 to 6 moist and chroma of 2 or 3 moist and dry. It is moderately calcareous to strongly calcareous.

Morrow series

The Morrow series consists of moderately deep, well drained soils formed in wind laid silt. These soils are on uplands. Slopes are 1 to 35 percent. The mean annual precipitation is about 13 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Morrow silt loam, 1 to 7 percent slopes, 110 feet west of gravel road, NE1/4SE1/4SE1/4 sec. 17, T. 3 S., R. 26 E.

Ap—0 to 9 inches, very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure, slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; upper one-fourth to one-half inch crusted and very vesicular; neutral (pH 6.8); abrupt smooth boundary.

IIB2t—9 to 14 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; very dark grayish brown (10YR 3/2) coatings on peds; weak fine prismatic structure parting to moderate medium angular blocky; very hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; many moderately thick clay films; neutral (pH 7.0); clear smooth boundary.

IIB3tca—14 to 19 inches; dark brown (10YR 3/3) heavy silt loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; few thin clay films; common light gray (10YR 7/2) lime seams; moderately calcareous; moderately alkaline (pH 8.0); abrupt smooth boundary.

IICca—19 to 26 inches; dark brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; massive; hard, friable, slightly sticky and slightly plastic; no roots; many to few fine tubular pores; very strongly calcareous seams of light brownish gray (10YR 6/2) soft segregated lime; moderately alkaline (pH 8.3); abrupt wavy boundary.

IIIR—26 inches; fractured basalt, fragments lime coated.

Depth to bedrock is 20 to 40 inches. The mollic epipedon is 13 to 20 inches thick.

The A horizon has value of 4 or 5 dry and 2 or 3 moist.

The IIB2t horizon is silty clay loam that is 27 to 35 percent clay. It has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3 moist and dry. The IIB3tca horizon has value of 5 or 6 dry and 3 or 4 moist and chroma of 2 or 3 moist and dry. It is 18 to 30 percent clay.

The Cca horizon has value of 6 or 7 dry and chroma of 2 or 3 moist or dry.

Nansene series

The Nansene series consists of deep, well drained soils formed in reworked loess. These soils are on north-facing slopes on uplands. The gradient is 35 to 70 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 50 degrees F.

Typical pedon of Nansene silt loam, 35 to 70 percent slopes, one-half mile east of Lexington, SE1/4SW1/4SW1/4 sec. 26, T. 1 S., R. 25 E.

A11—0 to 2 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate coarse platy structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral (pH 6.8); abrupt smooth boundary.

A12—2 to 11 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral (pH 6.8); clear smooth boundary.

A13—11 to 25 inches; very dark brown (10YR 2/2) coarse silt loam, dark grayish brown (10YR 4/2) dry; massive; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral (pH 7.2); gradual wavy boundary.

AC—25 to 38 inches; dark brown (10YR 3/3) silt loam, dark brown (10YR 4/3) dry; massive; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; mildly alkaline (pH 7.4); clear wavy boundary.

C—38 to 45 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; moderately alkaline (pH 8.0); abrupt wavy boundary.

IIR—45 inches; fractured basalt, lime in fractures.

The control section is 0 to 5 percent basalt fragments 1 inch or less in diameter. The surface is up to 5 percent large pebbles and cobbles. Depth to basalt is 40 to 60 inches. The mollic epipedon ranges from 30 to 50 inches in thickness.

The A11 horizon has weak fine platy or granular structure. The AC horizon has value of 4 or 5 dry and 2 or 3 moist. The C horizon has value of 4 through 7 dry and 3 through 5 moist. Some pedons are calcareous below 43 inches.

Onyx series

The Onyx series consists of very deep, well drained soils formed in alluvium from loess and volcanic ash. These soils are on alluvial bottom lands. Slopes are 0 to 3 percent. The mean annual precipitation is about 13 inches, and the mean annual air temperature is about 50 degrees F.

Typical pedon of Onyx silt loam, NE1/4SW1/4SW1/4 sec. 34, T. 3 S., R. 25 E.

A11—0 to 11 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine roots; many very fine and fine and few medium tubular pores; neutral (pH 7.0); clear smooth boundary.

A12—11 to 26 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; weak medium prismatic structure; soft, very friable, nonsticky and nonplastic; many fine roots; many very fine and fine and few medium tubular pores; neutral (pH 7.2); gradual smooth boundary.

AC—26 to 32 inches; very dark brown (10YR 2/2) very fine sandy loam, grayish brown (10YR 5/2) dry; weak fine prismatic structure; soft, very friable, nonsticky and nonplastic; many fine roots; many fine and very fine tubular pores; neutral (pH 7.0); abrupt wavy boundary.

C1—32 to 39 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, grayish brown (10YR 5/2) dry; massive; soft, very friable, nonsticky and nonplastic, many fine roots; neutral (pH 7.0); abrupt wavy boundary.

C2—39 to 60 inches; very dark grayish brown (10YR 3/2) gravelly very fine sandy loam, grayish brown (10YR 5/2) dry; massive; soft, very friable, nonsticky and nonplastic; many fine roots; 20 percent pebbles; neutral (pH 7.0); abrupt wavy boundary.

Depth to bedrock is more than 60 inches. The mollic epipedon is 20 to more than 40 inches thick. The control section is dominantly silt loam and very fine sandy loam that is 12 to 18 percent clay. In many pedons there are thin lenses less than 1 inch thick of very fine sandy loam, fine sandy loam, sandy loam, or medium sand. The A horizon has value of 2 or 3 moist and 4 or 5 dry and chroma of 2 or 3 moist and 2 through 4 dry

Pedigo series

The Pedigo series consists of very deep, somewhat poorly drained soils formed in water laid silt mixed with volcanic ash. These soils are on alluvial bottom lands. Slopes are 0 to 3 percent. The mean annual precipitation is about 13 inches, and the mean annual air temperature is about 50 degrees F.

Typical pedon of Pedigo silt loam about 60 feet northwest of a fence corner post, SE1/4SE1/4SE1/4 sec. 21, T. 2 N., R. 27 E.

A11—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; weakly calcareous; moderately alkaline (pH 8.0); clear smooth boundary.

A12—4 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; moderately calcareous, moderately alkaline (pH 8.2); clear wavy boundary.

B1—10 to 21 inches; dark brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; moderately calcareous; moderately alkaline (pH 8.3); clear smooth boundary.

B21—21 to 31 inches; dark brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to weak fine prismatic; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; strongly calcareous; strongly alkaline (pH 8.6); gradual wavy boundary.

C1—31 to 38 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; massive; hard, firm, slightly sticky and slightly plastic; common very fine roots; common very fine irregular pores; strongly calcareous; strongly alkaline (pH 8.6); abrupt wavy boundary.

C2—38 to 42 inches; dark brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) dry; massive; hard, firm, slightly sticky and slightly plastic; common very fine roots; common very fine irregular pores; few faint mottles; neutral (pH 7.0); abrupt wavy boundary.

C3—42 to 66 inches; brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine irregular pores; few faint mottles; neutral (pH 6.8).

Depth to bedrock is more than 60 inches. The mollic epipedon is 20 inches to more than 40 inches thick.

The A horizon has value of 2 or 3 moist and 4 through 6 dry and chroma of 1 through 3 moist and dry. The C horizon has hue of 10YR or 2.5Y, value of 3 or 4 moist and 5 or 6 dry, and chroma of 1 through 3 moist and dry.

Prosser series

The Prosser series consists of moderately deep, well drained soils formed in wind laid silts. These soils are on terraces. Slopes are 0 to 20 percent. The mean annual precipitation is about 8 inches, and the mean annual air temperature is about 53 degrees F.

Typical pedon of Prosser silt loam, 0 to 2 percent slopes, about 150 feet south of telephone pole road and pole guide wires, NE1/4SW1/4SW1/4 sec. 29, T. 4 N., R. 23 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; neutral (pH 6.8); clear smooth boundary.

B1—4 to 16 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral (pH 6.8); clear wavy boundary.

B21—16 to 29 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; 5 percent pebbles 2 millimeters in diameter; neutral (pH 7.2); clear smooth boundary.

IIR—29 inches; lime coated basalt.

Depth to consolidated bedrock is 20 to 40 inches.

The C horizon contains a few pebbles or cobbles in some pedons. It is very fine sandy loam or silt loam throughout.

Quincy series

The Quincy series consists of very deep, excessively drained soils formed in mixed sand. These soils are on uplands and terraces that have a ridged, hummocky, or duny microrelief. Slopes are 2 to 12 percent. The mean annual precipitation is about 8 inches, and the mean annual air temperature is about 53 degrees F.

Typical pedon of Quincy loamy fine sand, 2 to 12 percent slopes, 120 feet east of Pole road, NW1/4SW1/4NW1/4 sec. 11, T. 3 N., R. 26 E.

C1—0 to 6 inches; dark brown (10YR 3/3) loamy fine sand, brown (10YR 5/3) dry; single grained; loose; many very fine roots; many very fine irregular pores; neutral (pH 6.8); gradual wavy boundary.

C2—6 to 55 inches; dark brown (10YR 4/3) loamy fine sand, brown (10YR 5/3) dry; single grained; loose; few very fine roots; common very fine irregular pores; neutral (pH 6.8); gradual wavy boundary.

C3ca—55 to 60 inches; brown (10YR 4/3) loamy fine sand, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable; few very fine roots; few very fine irregular pores; strongly calcareous; moderately alkaline (pH 8.4); abrupt wavy boundary.

Depth to bedrock is more than 60 inches. The upper 20 inches is generally free of lime, but some small particles are brought up by insects and animals. The matrix below 20 inches is slightly calcareous in places. The 10- to 40-inch control section is sand to loamy fine sand. Less than 75 percent of the sand is very coarse, coarse, or medium, and the clay content is less than 5 percent.

The surface layer has hue of 7.5YR, 10YR, or 2.5Y; value of 4 through 6 dry and 3 through 5 moist; and chroma of 2 or 3 moist and dry. It is loamy fine sand or fine sand. The subsoil and substratum are similar to the surface layer in color but are as much as 1 unit higher in value.

Quinton series

The Quinton series consists of moderately deep, excessively drained soils that formed in mixed sand over basalt bedrock. These soils are on terraces. Slopes are 2 to 20 percent. The mean annual precipitation is about 8 inches, and the mean annual air temperature is about 53 degrees F.

Typical pedon of Quinton loamy fine sand, 2 to 20 percent slopes, 20 feet west of road NE1/4SE1/4NE1/4 sec. 22, T. 4 N., R. 24 E.

C1—0 to 7 inches; dark brown (10YR 3/3) loamy fine sand, brown (10YR 5/3) dry; single grained; loose, nonsticky and nonplastic; many very fine and fine roots; many very fine irregular pores; 5 percent pebbles and pan fragments; neutral (pH 7.0); gradual wavy boundary.

C2—7 to 30 inches; dark brown (10YR 3/3) loamy fine sand, brown (10YR 5/3) dry; single grained; loose, nonsticky and nonplastic; common very fine and fine roots; many very fine pores; neutral (pH 7.0); gradual wavy boundary.

C3—30 to 37 inches; dark brown (10YR 3/3) gravelly loamy fine sand, brown (10YR 5/3) dry; single grained; loose, nonsticky and nonplastic, common very fine and fine roots; many very fine irregular pores; 25 percent pebbles; neutral (pH 7.0); abrupt smooth boundary.

IIR—37 inches; basalt.

Depth to bedrock ranges from 20 to 40 inches. The control section is sand to loamy fine sand. These soils have hue of 10YR, 7.5YR, or 2.5Y; value of 3 through 5 moist and 4 through 7 dry; and chroma of 2 or 3 moist and dry.

Rhea series

The Rhea series consists of very deep, well drained soils formed in material from wind laid silt mixed with small amounts of volcanic ash. These soils are on uplands. Slopes are 1 to 35 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 49 degrees F.

Typical pedon of Rhea silt loam, 20 to 35 percent slopes, 300 feet west of gate and 30 feet south of road, NE1/4SE1/4SW1/4 sec. 19, T. 3 S., R. 24 E.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular to weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular and tubular pores; neutral (pH 6.6); abrupt smooth boundary.

A12—7 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral (pH 6.8); clear wavy boundary.

B21—14 to 22 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral (pH 7.0); clear smooth boundary.

B22—22 to 33 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral (pH 7.2); clear wavy boundary.

C1ca—33 to 45 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common to few very fine roots; many very fine tubular pores; moderately calcareous seams of soft segregated lime; moderately alkaline (pH 8.0); abrupt wavy boundary.

C2ca—45 to 76 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; very few very fine roots; many very fine tubular pores; strongly calcareous; common mycelium lime accumulations; moderately alkaline (pH 8.4); gradual wavy boundary.

Depth to partly consolidated bedrock is more than 60 inches. Depth to secondary carbonates ranges from 20 to 43 inches. The mollic epipedon is 7 to 20 inches thick. The control section is silt loam that is 18 to 24 percent clay and less than 15 percent material coarser textured than very fine sand.

The A horizon has value or 4 or 5 dry and 2 or 3 moist and chroma or 2 or 3 moist and dry. The B2 horizon has value of 4 or 5 dry and 3 or 4 moist and chroma of 2 or 3 moist and dry. The Cca horizon has value of 6 or 7 dry and 4 or 5 moist and chroma of 2 or 3 moist and dry.

Ritzville series

The Ritzville series consists of very deep, well drained soils formed in materials from wind laid silt and volcanic ash. These soils are on uplands on south- and west-facing slopes. The gradient is 0 to 40 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 49 degrees F.

Typical pedon of Ritzville silt loam, 0 to 2 percent slopes, 50 feet north, 10 feet west of quarter corner, and about 100 feet east of gravel road NE1/4NE1/4SW1/4 sec. 17, T. 2 N., R. 27 E.

Ap—0 to 6 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; neutral (pH 7.2); clear smooth boundary.

A12—6 to 13 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; mildly alkaline (pH 7.4); clear wavy boundary.

B21—13 to 25 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; mildly alkaline (pH 7.6); clear wavy boundary.

B22—25 to 33 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; moderately alkaline (pH 8.0); clear smooth boundary.

Clca—33 to 44 inches; brown (10YR 5/3) silt loam, light gray (10YR 7/2) dry; massive; hard, firm, slightly sticky and slightly plastic; few very fine roots; common very fine irregular pores; strongly calcareous; mycelium form of free lime; moderately alkaline (pH 8.2); abrupt wavy boundary.

C2ca—44 to 52 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few roots; common very fine irregular pores; moderately calcareous; mycelium form of free lime; strongly alkaline (pH 8.6); gradual wavy boundary.

C3ca—52 to 70 inches; brown (10YR 5/3) silt loam, light gray (10YR 7/2) dry; massive; hard, firm, slightly sticky and slightly plastic; few roots; few irregular pores; strongly calcareous; mycelium form of free lime; strongly alkaline (pH 8.6); abrupt wavy boundary.

Depth to secondary carbonates is 24 to 40 inches. The mollic epipedon is 8 to 14 inches thick.

The Ap horizon has value of 4 or 5 dry and chroma of 2 or 3 moist and dry. It is silt loam or very fine sandy loam. The B2 horizon has value of 4 through 6 dry and 3 or 4 moist. The Cca horizon has value or 6 or 7 dry and 4 or 5 moist.

Rockly series

The Rockly series consists of very shallow, well drained soils formed in loess, volcanic ash, and basalt residuum. These soils are on uplands. Slopes are 2 to 20 percent. The mean annual precipitation is about 21 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Rockly very gravelly loam, 2 to 20 percent slopes, SW1/4SE1/4SW1/4 sec. 35, T. 3 S., R. 28 E.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) very gravelly loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 45 percent pebbles; 5 percent cobbles; neutral (pH 6.8); clear wavy boundary.

B21—2 to 6 inches; very dark grayish brown (10YR 3/2) very gravelly loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 55 percent pebbles; 5 percent cobbles; slightly acid (pH 6.6); clear wavy boundary.

B22—6 to 9 inches; dark brown (10YR 3/3) very gravelly heavy loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; many very fine roots; many very fine tubular pores; 5 percent cobbles; 65 percent pebbles; slightly acid (pH 6.4); abrupt wavy boundary.

IIR—9 inches; basalt.

The thickness of the mollic epipedon and depth to bedrock range from 5 to 12 inches. The solum is 35 to 60 percent rock fragments consisting of pebbles, cobbles, and stones. The control section is loam, heavy loam, silt loam, or clay loam. Hue is 10YR, 7.5YR, or 5YR.

The A horizon has value of 2 or 3 moist and 4 or 5 dry and chroma of 2 or 3 moist and dry. The B2 horizon has value of 3 or 4 moist and chroma of 2 or 3 moist and dry.

Royal series

The Royal series consists of very deep, well drained soils formed in wind laid material. These soils are on foot slopes and terraces. Slopes are 0 to 20 percent. The mean annual precipitation is about 8 inches, and the mean annual air temperature is about 51 degrees F.

Typical pedon of Royal loamy fine sand, 2 to 5 percent slopes, 100 feet north of Homestead Road, about 10 miles southeast of Boardman SE1/4SE1/4SE1/4 sec. 8, T. 3 N., R. 26 E.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; moderately alkaline (pH 8.2); gradual smooth boundary.

B2—6 to 14 inches; dark brown (10YR 4/3) fine sandy loam, light brownish gray (10YR 6/2) dry; massive; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; moderately calcareous; moderately alkaline (pH 8.2); gradual smooth boundary.

C1ca—14 to 22 inches; dark brown (10YR 4/3) fine sandy loam, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; strongly calcareous; moderately alkaline (pH 8.3); clear wavy boundary.

C2ca—22 to 31 inches; dark grayish brown (10YR 4/2) fine sandy loam, light gray (10YR 7/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine irregular pores; strongly calcareous; moderately alkaline (pH 8.4); gradual wavy boundary.

C3ca—31 to 46 inches; dark grayish brown (10YR 4/2) loamy fine sand, light gray (10YR 7/2) dry; single grained; soft, nonsticky and nonplastic; strongly calcareous; moderately alkaline (pH 8.4); abrupt wavy boundary.

IIC4ca—46 to 60 inches; very dark gray (10YR 3/1) fine sand, dark gray (10YR 4/1) dry; single grained; basaltic and quartzitic sand; strongly calcareous; moderately alkaline (pH 8.2).

Depth to lime is 10 to 24 inches. Depth to bedrock is more than 60 inches.

The A horizon has value of 3 to 5 moist and chroma of 2 or 3 moist and dry. It is fine sandy loam, loamy fine sand, or silt loam.

The B2 horizon has value of 6 or 7 dry and 4 or 5 moist and chroma of 2 or 3 dry or moist.

The C horizon has value of 6 or 7 dry and 4 or 5 moist and chroma of 1 through 3 moist and dry It is stratified fine sandy loam, loamy fine sand, and fine sand.

Sagehill series

The Sagehill series consists of very deep, well drained soils formed in wind laid material and calcareous lacustrine sediment. These soils are on terraces. Slopes are 2 to 20 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 51 degrees F.

Typical pedon of Sagehill fine sandy loam, 2 to 5 percent slopes, SW1/4SW1/4NW1/4 sec. 30, T. 3 N., R. 26 E.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; neutral (pH 7.2); abrupt smooth boundary.

A12—2 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine platy structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; many very fine tubular pores; mildly alkaline (pH 7.6); abrupt smooth boundary.

B2—5 to 21 inches; dark brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; mildly alkaline (pH 7.8); clear wavy boundary.

C1—21 to 28 inches; dark brown (10YR 4/3) fine sandy loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; moderately alkaline (pH 8.2); clear wavy boundary.

IIC2ca—28 to 49 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; moderately calcareous; few firm brown (10YR 5/3) dry nodules one-half inch to 2 inches in diameter; mycelium form of lime in nodules; moderately alkaline (pH 8.4); clear wavy boundary.

IIC3ca—49 to 60 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; massive; very hard, firm, slightly sticky and slightly plastic laminated silt; few very fine roots; common very fine tubular pores; strongly calcareous; strongly alkaline (pH 8.8).

Depth to bedrock is more than 60 inches. Depth to lime is 15 to 30 inches.

The A horizon has value of 5 or 6 dry and chroma of 2 or 3 moist and dry.

The B2 horizon has value of 5 or 6 dry and chroma of 2 or 3 moist and dry. It is very fine sandy loam, loamy very fine sand, or fine sandy loam.

The IIC horizon has value of 4 or 5 moist and 6 or 7 dry and chroma of 2 or 3 moist and dry. It is stratified silt loam, very fine sandy loam, and fine sandy loam.

Snell series

The Snell series consists of moderately deep, well drained soils formed in wind laid silt mixed with basalt colluvium. These soils are on north-facing slopes near the fringe of timbered areas. The gradient is 35 to 70 percent. The mean annual precipitation is about 17 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Snell very stony loam, 35 to 70 percent north slopes, one-fourth mile east of Willow Creek road in SW1/4NW1/4SW1/4 sec. 28, T. 3 S., R. 28 E.

A11—0 to 4 inches; very dark brown (10YR 2/2) very stony loam, very dark grayish brown (10YR 3/2) dry; moderate very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 1 percent of surface covered with stones; 5 percent pebbles; slightly acid (pH 6.4); clear smooth boundary.

A12—4 to 14 inches; black (10YR 2/1) light silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate very fine granular structure; slightly hard, very friable, sticky and plastic; many very fine roots; many very fine irregular pores; 5 percent pebbles; slightly acid (pH 6.4); clear wavy boundary.

B21t—14 to 22 inches; very dark brown (10YR 2/2) very cobbly silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; 30 percent cobbles; 20 percent pebbles; many very fine roots; many very fine tubular pores; slightly acid (pH 6.4); few thin clay films and cutans; clear smooth boundary.

B22t—22 to 30 inches; dark yellowish brown (10YR 3/4) extremely cobbly silty clay loam, brown (10YR 4/3) dry; moderate fine subangular blocky structure; very hard, friable, very sticky and very plastic; 40 percent cobbles; 25 percent pebbles; many very fine roots; many very fine tubular pores; slightly acid (pH 6.4); few thin clay films and cutans; abrupt wavy boundary.

R—30 inches; basalt.

Depth to bedrock is 20 to 40 inches.

The A horizon has value of 2 or 3 moist and 3 or 4 dry and chroma of 1 or 2 moist and dry. Stones cover 1 to 3 percent of the surface.

The B2t horizon has value of 2 or 3 moist and 3 or 4 dry and chroma of 2 through 4. It is silty clay loam or clay. It is 35 to 45 percent clay and 40 to 65 percent rock fragments, mainly cobbles and stones.

Snow series

The Snow series consists of very deep, well drained soils formed in alluvium from loess and volcanic ash. These soils are on alluvial bottom lands. Slopes are 0 to 3 percent. The mean annual precipitation is about 17 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Snow silt loam SW1/4SE1/4SW1/4 sec 5, T. 3 S., R. 28 E.

A11—0 to 4 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine irregular pores; neutral (pH 6.8); abrupt smooth boundary.

A12—4 to 18 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; neutral (pH 6.8); gradual wavy boundary.

A13—18 to 33 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; neutral (pH 6.8); gradual wavy boundary.

B2—33 to 46 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; neutral (pH 6.8); gradual wavy boundary.

C—46 to 60 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; neutral (pH 6.8);

Depth to bedrock is more than 60 inches. The mollic epipedon ranges from 30 to 48 inches in thickness. The A horizon has value of 2 or 3 moist and 4 or 5 dry and chroma of 1 or 2 moist and dry. The B horizon has value of 3 or 4 moist and 4 or 5 dry and chroma of 2 or 3 moist and dry. It is 18 to 27 percent clay.

Taunton series

The Taunton series consists of moderately deep, well drained soils formed in wind laid alluvium. These soils are on high terraces. Slopes are 0 to 12 percent. The mean annual precipitation is about 8 inches, and the mean annual air temperature is about 50 degrees F.

Typical pedon of Taunton fine sandy loam, 0 to 2 percent slopes, 20 feet west of road in NE1/4NE1/4NE1/4 sec. 30, T. 3 N., R. 27 E.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; neutral (pH 6.8); abrupt smooth boundary.

B2—5 to 15 inches; dark brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; moderately alkaline (pH 8.2); clear wavy boundary.

C1ca—15 to 32 inches; dark brown (10YR 4/3) fine sandy loam, light gray (10YR 7/2) dry; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; moderately calcareous; moderately alkaline (pH 8.4); abrupt smooth boundary.

IIC2casim—32 inches; light gray (10YR 7/2) indurated duripan, white (10YR 8/1) dry; strongly calcareous.

Depth to the duripan is 20 to 40 inches. The A horizon has value of 5 or 6 dry and chroma of 2 or 3 moist and dry. The B2 and C1ca horizons have value of 6 or 7 dry and 4 or 5 moist and chroma of 2 or 3 moist and dry.

Tolo series

The Tolo series consists of very deep, well drained soils formed in volcanic ash and wind laid silt overlying colluvium from basalt and granite. These soils are on tops of plateaus and on north-facing slopes of the Blue Mountains. The gradient is 3 to 60 percent. The mean annual precipitation is about 23 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Tolo silt loam, 15 to 35 percent slopes, 30 feet south of road in NE1/4NE1/4NE1/4 sec. 7, T. 6 S., R. 28 E.

O1—1 1/2 inches to 0; fir needles and twigs.

A1—0 to 3 inches; very dark brown (10YR 2/2) silt loam, brown (10YR 5/3) dry; weak very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many medium and fine roots; many very fine pores; neutral (pH 6.6); clear smooth boundary.

B21—3 to 10 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/3) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many medium and fine roots; many very fine pores; neutral (pH 6.6); gradual smooth boundary.

B22—10 to 16 inches; yellowish brown (10YR 5/6) silt loam, very pale brown (10YR 7/4) dry; massive; soft, very friable, nonsticky and nonplastic; many medium and fine roots; many very fine pores; neutral (pH 6.6); clear smooth boundary.

B23—16 to 25 inches; very pale brown (10YR 7/3) silt loam, white (10YR 8/1) dry; massive; soft, very friable, nonsticky and nonplastic; many medium and fine roots; many very fine pores; neutral (pH 6.6); abrupt irregular boundary.

IIB21b—25 to 41 inches; dark brown (7.5YR 3/3) loam, brown (7.5YR 5/4) dry; very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common medium and fine roots; many very fine pores; neutral (pH 6.6); clear smooth boundary.

IIB22b—41 to 60 inches; dark brown (7.5YR 4/4) cobbly clay loam, brown (7.5YR 5/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic, few roots; many very fine tubular pores; 30 percent cobbles; 5 percent pebbles; neutral (pH 6.6).

Depth to bedrock is more than 60 inches. The ashy material is 20 to 40 inches thick.

The A horizon has value of 3 or 4 moist and 5 or 6 dry and chroma of 2 or 3 moist and dry.

The B horizon has value of 4 or 5 moist and 6 through 8 dry and chroma of 2 through 4 moist and dry. It is silt loam or loam. The IIB2 horizon has hue of 7.5YR or 10YR, value of 3 through 5 moist and 5 or 6 dry, and chroma of 2 through 4 moist and dry. It ranges from loam to silty clay loam that is 18 to 35 percent clay. The lower part is up to 35 percent rock fragments.

Ukiah series

The Ukiah series consists of moderately deep, well drained soils formed in colluvium from volcanic tuff and loess. These soils are on south-facing slopes. The gradient is 5 to 30 percent. The mean annual precipitation is about 18 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Ukiah stony silty clay loam, 5 to 30 percent slopes, 75 feet south of road near head of Johnson Creek in NW1/4NE1/4 sec. 3, T. 4 S., R. 29 E.

A11—0 to 3 inches; black (10YR 2/1) stony silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium platy structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; many very fine tubular pores; 10 percent cobbles, 5 percent pebbles; neutral (pH 6.6); clear smooth boundary.

A12—3 to 7 inches; very dark brown (10YR 2/2) cobbly silty clay, dark grayish brown (10YR 4/2) dry; moderate fine to medium subangular blocky structure; hard, friable, sticky and plastic; common fine and very fine roots; many very fine tubular pores; 10 percent cobbles, 5 percent pebbles; neutral (pH 6.8); abrupt wavy boundary.

B21t—7 to 21 inches; dark brown (10YR 3/3) cobbly clay, dark grayish brown (10YR 4/2) dry; moderate medium to coarse prismatic structure parting to strong medium subangular blocky; very hard, very friable, very sticky and very plastic; few very fine and fine roots; many very fine tubular pores; 10 percent cobbles, 5 percent pebbles; many pressure faces; many cracks one-fourth to one-half inch wide; neutral (pH 7.0); clear smooth boundary.

B22t—21 to 26 inches; brown (10YR 4/3) cobbly clay, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many very fine tubular pores; 10 percent cobbles, 5 percent pebbles; neutral (pH 7.0); clear wavy boundary.

Cr—26 inches; weathered volcanic tuff.

The mollic epipedon is 15 to 30 inches thick. Depth to the paralithic contact is 20 to 40 inches. In summer cracks at least 1 centimeter wide form at a depth of 20 inches and extend to the surface. Stones cover 1 to 15 percent of the surface.

The A horizon has value of 2 or 3 moist and chroma of 1 or 2 moist and dry.

The B2t horizon has value of 4 or 5 dry and 2 or 3 moist in the upper part and 5 or 6 dry and 3 or 4 moist in the lower part. Chroma is 2 or 3 moist and dry. This horizon is 50 to 60 percent clay and 15 to 35 percent rock fragments.

Utley series

The Utley series consists of very deep, well drained soils formed in materials from basalt and soft volcanic rock. Utley soils are on foot slopes. Slopes are 8 to 20 percent. The mean annual precipitation is about 21 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Utley loam, 8 to 20 percent slopes, on east side of logging road, one-fourth mile north of Rhea Creek Road, SW1/4NW1/4SE1/4 sec. 2, T. 5 S., R. 27 E.

A11—0 to 6 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; 10 percent pebbles; slightly acid (pH 6.4); clear smooth boundary.

A12—6 to 16 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; many very fine tubular pores; 15 percent pebbles; slightly acid (pH 6.5); abrupt wavy boundary.

B21—16 to 26 inches; dark grayish brown (2.5Y 3/2) shaly loam, grayish brown (2.5Y 5/2) dry; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few roots; common very fine tubular pores; 30 percent pebbles; neutral (pH 6.6); abrupt wavy boundary.

B22—26 to 38 inches; dark grayish brown (2.5Y 3/2) shaly loam, grayish brown (2.5Y 5/2) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few roots; common very fine tubular pores; 20 percent pebbles; slightly acid (pH 6.4); abrupt irregular boundary.

C—38 to 60 inches; dark grayish brown (2.5Y 3/2) very shaly loam, grayish brown (2.5Y 5/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; few roots; 50 percent pebbles; slightly acid (pH 6.4).

The solum is 30 to 40 inches thick. Depth to consolidated bedrock is more than 60 inches. The mollic epipedon is 10 to 20 inches thick. These soils have hue of 2.5Y or 10YR.

The B horizon is loam or shaly loam. It is 20 to 35 percent pebbles. The C horizon is very shaly sandy loam or very shaly loam. It is 35 to 60 percent pebbles.

Valby series

The Valby series consists of moderately deep, well drained soils that formed in loess over basalt. Valby soils are on uplands of the Columbia Plateau. Slopes range from 1 to 30 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 49 degrees F.

Typical pedon of Valby silt loam, 1 to 7 percent slopes, 110 feet east of Valby Road in NE1/4NW1/4SW1/4 sec. 28 T. 3 S., R. 24 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; neutral (pH 6.8); clear smooth boundary.

B21—8 to 14 inches; very dark grayish brown (10YR 3/2) heavy silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular pores; neutral (pH 6.8); clear smooth boundary.

B22—14 to 25 inches; dark brown (10YR 4/3) heavy silt loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular pores; neutral (pH 7.2); clear wavy boundary.

IICca—25 to 30 inches; dark brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; strongly calcareous mycelium lime on peds and in pores; 5 percent pebbles; moderately alkaline (pH 8.3); abrupt wavy boundary.

IIIR—30 inches; fractured basalt; fragments lime coated.

Depth to bedrock ranges from 20 to 40 inches. Coarse fragments in the Cca horizon range up to 10 percent.

The A horizon has value of 2 or 3 moist and 4 or 5 dry and chroma of 2 or 3 moist and dry. The B2 horizon has value of 3 or 4 moist and 4 or 5 dry and chroma of 2 or 3 moist and dry. The Cca horizon has value of 4 or 5 moist and 6 or 7 dry. Chroma is 2 or 3 moist and dry.

Waha series

The Waha series consists of moderately deep, well drained soils formed in wind laid silt. These soils are on north-facing slopes of uplands. The gradient is 1 to 40 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Waha silt loam, 7 to 25 percent north slopes, SW1/4NE1/4NW1/4 sec. 7, T. 4 S., R. 27 E.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; weak medium to fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; neutral (pH 6.6); abrupt smooth boundary.

A12—7 to 12 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral (pH 6.9); clear smooth boundary.

B21t—12 to 19 inches, very dark grayish brown (10YR 3/2) silty clay loam, brown (10YR 4/3) dry; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots; many very fine tubular pores; 2 percent pebbles; neutral (pH 6.9); clear smooth boundary.

B22t—19 to 27 inches, dark brown (10YR 3/3) silty clay loam, brown (10YR 4/3) dry; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; 2 percent pebbles, neutral (pH 6.9); abrupt wavy boundary.

B3t—27 to 29 inches; dark brown (7.5YR 4/4) very gravelly clay loam, brown (7.5YR 5/4) dry; massive; slightly hard, friable, sticky and plastic; common very fine roots; few very fine tubular pores; 60 percent pebbles; neutral (pH 6.9); abrupt wavy boundary.

IIR—29 inches; basalt.

Depth to bedrock ranges from 20 to 40 inches. The mollic epipedon is 20 to 30 inches thick. The content of rock fragments is 5 to 25 percent.

The A1 horizon has value of 3 or 4 dry and 2 moist and chroma of 1 or 2 moist and dry. The B2t horizon has value of 4 or 5 dry and 3 or 4 moist and chroma of 2 or 3 moist and dry. It is heavy silt loam or silty clay loam.

Warden series

The Warden series consists of very deep, well drained soils formed in wind laid silt over calcareous lacustrine silt. These soils are on terraces and uplands. Slopes are 0 to 40 percent. The mean annual precipitation is about 8 inches, and the mean annual air temperature is about 51 degrees F.

Typical pedon of Warden silt loam, 2 to 5 percent slopes, about 150 feet south of paved road and 40 feet west of a gravel road in NE1/4NE1/4NE1/4 sec. 29, T. 2 N., R. 26 E.

Ap—0 to 5 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; weak thin platy to weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine irregular pores, neutral (pH 7.2); clear wavy boundary.

B21—5 to 15 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; mildly alkaline (pH 7.4); clear smooth boundary.

B22ca—15 to 25 inches; brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; moderately calcareous; moderately alkaline (pH 8.4); clear wavy boundary.

C1ca—25 to 38 inches; brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine irregular pores; moderately calcareous; moderately alkaline (pH 8.4); clear wavy boundary.

IIC2ca—38 to 45 inches; brown (10YR 5/3) silt loam, light gray (10YR 7/2) dry; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine irregular pores; strongly calcareous; moderately alkaline (pH 8.4); abrupt wavy boundary.

IIC3ca—45 to 60 inches; brown (10YR 5/3) silt loam, light gray (10YR 7/2) dry; massive; very hard, friable, slightly sticky and slightly plastic; common very fine irregular pores; strongly calcareous; strongly alkaline (pH 8.6).

Depth to lime is 15 to 30 inches. Depth to bedrock is more than 60 inches. Hue is 10YR or 2.5Y.

The Ap horizon has value of 5 or 6 dry and chroma of 2 or 3 moist and dry. It is silt loam or very fine sandy loam.

The B2 horizon has value of 5 or 6 dry and chroma of 2 or 3 moist and dry. It is silt loam or very fine sandy loam.

The C horizon has value of 4 or 5 moist and 6 or 7 dry and chroma of 2 or 3 moist and dry. It is silt loam or very fine sandy loam.

Waterbury series

The Waterbury series consists of shallow, well drained soils formed in colluvium from basalt. These soils are on west- and south-facing slopes. The gradient is 7 to 70 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Waterbury extremely stony silt loam, 7 to 40 percent slopes, one-fourth mile from Willow Creek Road in SE1/4SW1/4NW1/4 sec. 28, T. 3 S., R. 28 E.

A11—0 to 3 inches; black (10YR 2/1) extremely stony silt loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine irregular pores; 40 percent cobbles; 15 percent pebbles; 10 percent stones; neutral (pH 6.6); clear smooth boundary.

A12—3 to 9 inches; black (10YR 2/1) very cobbly silt loam, dark gray (10YR 4/1) dry; moderate very fine subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine tubular pores; 35 percent cobbles; 10 percent pebbles; neutral (pH 6.8); clear smooth boundary.

B21t—9 to 15 inches; black (10YR 2/1) very cobbly clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; 30 percent cobbles; 10 percent pebbles; neutral (pH 6.8); clear smooth boundary.

B22t—15 to 17 inches; dark brown (10YR 3/3) very cobbly clay, very dark grayish brown (10YR 4/2) dry; moderate medium angular blocky structure; very hard, very firm, very sticky and very plastic; many very fine roots; many very fine tubular pores; 30 percent cobbles; 15 percent pebbles; neutral (pH 6.8); abrupt wavy boundary.

R—17 inches; basalt.

Depth to basalt bedrock ranges from 12 to 20 inches. The solum ranges from 35 to 80 percent rock fragments, mainly of basalt stones and cobbles and some pebble-sized volcanic tuff.

The A horizon has value of 3 or 4 dry and chroma of 1 or 2 moist and dry. The surface is 3 to 15 percent stones. The B2t horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 1 through 3 moist and dry.

Willis series

The Willis series consists of moderately deep, well drained soils formed in loess. These soils are on ridgetops. Slopes are 2 to 40 percent. The mean annual precipitation is about 10 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Willis silt loam, 2 to 5 percent slopes, 75 feet north of Strawberry Road and 65 feet northwest of grain bin in SE1/4SE1/4SE1/4 sec. 17, T. 1 N., R. 25 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; neutral (pH 6.8); clear smooth boundary.

A12—8 to 12 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak moderate subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral (pH 6.8); clear wavy boundary.

B2—12 to 21 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium to coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; moderately alkaline (pH 7.0); abrupt wavy boundary.

C1—21 to 27 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; weakly calcareous; moderately alkaline (pH 8.0); clear wavy boundary.

C2ca—27 to 35 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine irregular pores; strongly calcareous; moderately alkaline (pH 8.4); clear wavy boundary.

IICcasim—35 to 39 inches; light gray (10YR 7/2), duripan, white (10YR 8/1) dry; massive; indurated.

Depth to the lime-silica cemented hardpan ranges from 20 to 40 inches. The mollic epipedon is 12 to 18 inches thick. Pan fragments are common throughout the profile.

The A horizon has value of 2 or 3 moist and 4 or 5 dry and chroma of 2 or 3 moist and dry. The B horizon has value of 3 or 4 moist and 5 or 6 dry and chroma of 3 or 4 moist and dry. The C and Csim horizons have value of 5 through 8 dry and 3 through 6 moist and chroma of 1 through 4 moist and dry.

Winchester series

The Winchester series consists of very deep, excessively drained soils formed in alluvial sand. These soils are on hummocky or dunelike terraces. Slopes are 0 to 12 percent. The mean annual precipitation is about 7 inches, and the mean annual air temperature is about 53 degrees F.

Typical pedon of Winchester sand, 0 to 12 percent slopes, about 300 feet east of Eighth Street West, NE1/4SW1/4SW1/4 sec. 26, T. 5 N., R 26 E.

C1—0 to 18 inches; very dark grayish brown (10YR 3/2) sand, grayish brown (10YR 5/2) dry; single grained; loose, nonsticky and nonplastic; many fine and very fine roots; many very fine irregular pores; 5 percent rock fragments 2 millimeters to 3 inches in diameter; neutral (pH 6.8); gradual wavy boundary.

C2—18 to 36 inches; very dark grayish brown (10YR 3/2) coarse sand, dark grayish brown (10YR 4/2) dry; single grained; loose, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; neutral (pH 7.0); clear wavy boundary.

C3—36 to 60 inches; very dark gray (10YR 3/1) coarse sand, dark gray (10YR 4/1) dry; single grained; loose, nonsticky and nonplastic; common very fine roots; common very fine irregular pores; weakly calcareous; mildly alkaline (pH 8.0)

Depth to bedrock is more than 60 inches. The soils are free of lime in the upper 20 inches, but some pedons are slightly calcareous in the matrix below 20 inches. The 40-inch control section is more than 75 percent sand that is very coarse, coarse, and medium. It is less than 5 percent clay and from 0 to 15 percent coarse fragments.

The C1 and C2 horizons have hue ranging from 7.5YR to 2.5Y, value of 4 to 7 dry and 3 to 5 moist, and chroma of 1 through 3 moist and dry.

Wrentham series

The Wrentham series consists of moderately deep, well drained soils formed in wind laid silt and basalt colluvium. These soils are on north-facing slopes. The gradient is 35 to 70 percent. The mean annual precipitation is about 13 inches, and the mean annual air temperature is about 49 degrees F.

Typical pedon of Wrentham-Rock outcrop complex, 35 to 70 percent slopes, SE1/4NE1/4NE1/4 sec. 27, T. 4 S., R. 26 E.

A11—0 to 4 inches; black (10YR 2/1) silt loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine roots, many very fine tubular pores; 10 percent gravel; neutral (pH 7.0); clear smooth boundary.

A12—4 to 9 inches; black (10YR 2/1) gravelly silt loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine roots; many very fine tubular pores; 15 percent gravel; neutral (pH 6.8); clear smooth boundary.

A13—9 to 14 inches; black (10YR 2/1) gravelly silt loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic, many fine roots; many very fine tubular pores; 20 percent gravel; neutral (pH 6.8); clear wavy boundary.

A3—14 to 20 inches; very dark brown (10YR 2/2) very cobbly silt loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores, 25 percent pebbles; 15 percent cobbles; neutral (pH 6.6); clear smooth boundary.

B2—20 to 32 inches; dark brown (10YR 3/3) very cobbly silt loam, brown (10YR 4/3) dry; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; 30 percent pebbles; 20 percent cobbles; neutral (pH 6 6); abrupt wavy boundary.

IIR—32 inches; fractured basalt.

Depth to bedrock ranges from 20 to 40 inches. The mollic epipedon is 20 to 36 inches thick.

The A horizon has value of 2 or 3 moist and 3 through 5 dry and chroma of 1 or 2 moist and dry. It is 0 to 25 percent pebbles and 0 to 20 percent cobbles.

The B horizon has value of 3 or 4 moist and 4 or 5 dry and chroma of 2 through 4 moist and dry. It is loam, silt loam, or silty clay loam that is 35 to 60 percent cobbles and 5 to 25 percent pebbles.

Wrightman series

The Wrightman series consists of moderately deep, well drained soils formed in material weathered from basalt rock and in reworked loess. These soils are on ridgetops in the Blue Mountains. Slopes are 2 to 12 percent. The mean annual precipitation is 25 inches, and the mean annual air temperature is 44 degrees F.

Typical pedon of Wrightman silt loam, 2 to 12 percent slopes, NE1/4SE1/4SW1/4 sec. 14, T. 6 S., R. 29 E.

A11—0 to 3 inches; dark brown (7.5YR 3/3) silt loam, brown (7.5YR 5/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; 5 percent pebbles; neutral (pH 6.8); clear smooth boundary.

A12—3 to 12 inches; dark brown (7.5YR 3/3) silt loam, brown (7.5YR 5/3) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; 5 percent pebbles; neutral (pH 6.8); clear smooth boundary.

B22—12 to 21 inches; dark brown (7.5YR 3/3) silt loam, brown (7.5YR 5/3) dry; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many fine tubular pores; 5 percent pebbles; neutral (pH 6.6); gradual smooth boundary.

B23—21 to 26 inches; dark brown (7.5YR 4/3) gravelly silt loam, light brown (7.5YR 6/3) dry; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; 20 percent pebbles; neutral (pH 6.6); abrupt wavy boundary.

R—26 inches; fractured basalt.

The control section averages less than 15 percent pebbles. The horizon over the bedrock is gravelly in most pedons. Depth to bedrock is 20 to 40 inches. The mollic epipedon is 20 to 30 inches thick. The solum has hue ranging from 10YR through 5YR.

The A horizon has value of 2 or 3 moist and 4 or 5 dry and chroma of 2 or 3 moist and dry. The B horizon has value of 3 or 4 moist and 5 or 6 dry and chroma of 3 or 4 moist and dry. It is loam, silt loam, or clay loam that is 18 to 30 percent clay.

Xeric Torriorthents

Xeric Torriorthents consist of deep, somewhat excessively drained soils formed in water laid and wind laid material. These soils generally are in canyon bottoms. Slopes are 0 to 2 percent. The mean annual precipitation is 8 to 9 inches, and the mean annual air temperature is about 51 degrees F.

Pedon of Xeric Torriorthents, nearly level, 250 feet north of fence in canyon bottom in SW1/4NW1/4SE1/4 sec. 26, T. 2 N., R. 26 E.

A1—0 to 6 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many roots; 10 percent pebbles; neutral (pH 6.6); clear smooth boundary.

C1—6 to 15 inches; dark brown (10YR 3/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many roots; many fine tubular pores; 15 percent pebbles; neutral (pH 6.8); clear smooth boundary.

C2—15 to 19 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; few roots, few pores; 30 percent pebbles; neutral (pH 7.0); abrupt wavy boundary.

C3—19 to 30 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; 35 percent pebbles and cobbles; mildly alkaline (pH 7.4); abrupt wavy boundary.

IIC4—30 to 60 inches; dark grayish brown (10YR 4/2) very gravelly loamy sand, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; 55 percent cobbles and pebbles; moderately alkaline (pH 7.9).

The A horizon is sandy loam or fine sandy loam. It is 0 to 15 percent pebbles.

The C horizon is fine sandy loam, sandy loam, loamy sand, gravelly fine sandy loam, gravelly sandy loam, or gravelly loamy sand. It is 10 to 30 percent pebbles. It has value of 3 or 4 dry and chroma of 2 or 3 dry.

The IIC horizon is gravelly loamy sand, very gravelly loamy sand, cobbly loamy sand, or very cobbly loamy sand. It is 10 to 30 percent cobbles and 15 to 30 percent pebbles.

Formation of the soils

The paragraphs that follow describe the factors of soil formation and relate them to the formation of the soils of the area.

Factors of soil formation

Soil is a segment of landscape that consists of unconsolidated material capable of supporting plants, such as trees, shrubs, and grasses. The factors and processes that formed the soils in the Morrow County Area and contributed to many of their distinctive characteristics are described on the pages that follow.

Soil forms through the interaction of five major factors (*7*): climate, plant and animal life, parent material, relief, and time. The relative influence of each factor varies from place to place. In some cases, a single factor can determine most properties of a soil.

Because of major differences in parent material, plant and animal life, relief, and climate, the area has been divided into three zones.

The first of these zones is adjacent to the Columbia River. It extends across the area from east to west and south about 12 miles from the Columbia River. On the general soil map, it includes map units 1 through 5. No perennial streams cross this zone.

Parent material, climate, and vegetation are the dominant factors in determining the characteristics of the soils of this zone.

The zone is underlain by Columbia River basalt, which was deposited during the Miocene epoch. These deposits built up to a maximum thickness of 4,000 feet. The weight of these basalt layers caused faulting throughout the zone, the most important of which is the Columbia River fault. This fault helped form the present drainage pattern of the Columbia River. Geologic events near the end of the ice age in the Pleistocene epoch greatly influenced the characteristics of the soils in the zone. As melt waters from receding glaciers to the north rushed down the Columbia River, they carried debris that dammed the Columbia River gorge, probably at least three times. See "The Geography, Morphology, and Environmental Relationships of the Walla Walla Soil Series in Oregon," by Luther Henry Robinson, Jr , unpublished Master's thesis, issued June 1961, [pp. 4-11, illus]. In the lakes that formed behind these dams, lacustrine silts were deposited to an elevation of about 1,000 feet During intermediate periods the floodwater scoured away the lacustrine deposits nearest the river and deposited sandy and gravelly alluvium. The then prevailing winds from the north reworked the sandy material and deposited a sandy layer over the lacustrine deposits farther south of the Columbia River. See "Distribution and Characteristics of Loess-Like Soil Parent Material in Northwestern Oregon," by Arthur Albert Theison, unpublished Master's thesis, issued June 1958, [pp. 58-60, illus]. In more recent times, the prevailing winds from the west and southwest reoriented the sandy deposits in a southwest to northeast direction. Soils formed in these sandy materials show little profile development because the sand resists weathering.

The climate in this zone is dry. The average annual precipitation is 7 to 8 inches. Consequently, the vegetation is sparse.

Nearly all soils in this zone are sandy, at least in the upper part. Some are sandy throughout Near the Columbia River the very deep sandy soils overlying basalt or river gravel are the Quincy, Royal, and Winchester soils. Quinton soils are moderately deep over basalt. Koehler, Ellum, and Taunton soils are underlain by a hardpan. Burbank and Irrigon soils consist of wind reworked sandy material over sandy and gravelly alluvial outwash. Hezel and Sagehill soils are eolian sands, from near the Columbia River, over lacustrine silts. Warden soils, which are southernmost in this zone, are on terraces of eolian sands and silts over lacustrine sediments. Throughout this zone where plant cover has been removed, long, active sand dunes are oriented in a southwest to northeast direction.

The zone to the south of the sandy northern zone and extending to the Blue Mountains is dominantly loess or wind laid deposits. See map units 6 through 14 on the general soil map. The loess probably originated from glacial outwash from the receding glaciers and the material deposited by the Columbia River in the Pleistocene epoch. The interglacial periods, accompanied by warmer climate, produced maximum sedimentation. Concurrently, when the ground was not frozen and not snow covered, these deposits were exposed to the prevailing northeast winds.

Wind is capable of moving soil particles up to the size of coarse sand. Such particles are rolled or bounced along the surface. Because of this type of movement and the size of such particles, they are carried only a short distance and are the first to be deposited. The bouncing of these larger sand particles also dislodges other particles and subjects them to the force of the wind. Fine and very fine sands and coarse silts are carried by the wind in suspension for short distances. These are the next particles to be deposited downwind from the source. Finally, because of their size and weight, the fine silts and clays are carried in suspension for a considerable distance and are deposited farthest from the source. Also wind laid deposits are deepest near the source and thinner farther from it. Precipitation in the zone increases to the southward. These facts explain much of the development of the soils in this loess zone.

All the loess soils are underlain by basalt bedrock. Ritzville, Mikkalo, Willis, and Nansene soils, in the northern part of the loess zone, are dominated by coarse silts. Ritzville and Nansene soils are deep. Nansene soils are on north exposures. Ritzville soils are near the source of loess and on ridgetops and north exposures. The moderately deep Mikkalo soils formed farther from the source of loess where it is thinner and on south exposures. Willis soils, in level and slightly concave areas, have a hardpan.

The loess soils in the rest of this zone are farther from the source and are dominantly fine silts. They are under heavier precipitation and have a darker colored surface layer. Rhea soils have north exposures and are deep. Valby soils, on ridgetops and south-facing slopes, are moderately deep. Morrow and Waha soils are on older surfaces at the higher elevations in the southern part of the zone. They are moderately deep and have a distinct argillic horizon. Bakeoven and Rockly soils, formed on rocky ridgetops and near the edge of ridgetops, are very shallow and show little soil development. Bakeoven soils are often interspersed with Valby and Morrow soils as patterned land, locally known as biscuit scabland. The origin of these biscuits or mounds is not definitely known, but it is commonly thought that they originated as frost wedges and were then eroded to mounds. Rockly soils are similarly related to Waha soils. The light colored Lickskillet soil, in the northern two-thirds of this zone, is shallow because the low moisture results in sparse vegetation, making the soil more susceptible to erosion. South-facing slopes in the southern part of the zone are dominantly Waterbury soils. The higher precipitation and increased vegetation caused them to develop a darker surface horizon and an argillic horizon. Wrentham and Snell soils, on steep north exposures, formed a thick dark surface layer.

Three main streams—Willow Creek, Rhea Creek, and Butter Creek—cross this zone. Relief and parent material are highly significant in the formation of these soils because the soils formed in alluvial deposits eroded from the upland soils in this zone and in the Blue Mountains. Pedigo soils, in slightly concave areas, have impeded drainage. Esquatzel and Kimberly soils, in the drier northern part of the zone, are lighter colored and have extensive lime zones. Onyx, Endersby, and Snow soils, receiving more precipitation than these soils, are darker colored and free of lime.

The third zone, in the southern part of the area, includes the western extension of the Blue Mountains. See map units 15 through 18 on the general soil map. Except for the flats and steep slopes that break into the North Fork of the John Day River and the scattered high mountain meadows, all this zone is timbered. The Blue Mountains in this zone were formed by the uplifting and folding of Columbia River basalt. There are some intrusions of granite and granodiorite.

This zone has the highest precipitation in the county, which accounts for the forest-type vegetation in most areas. The average annual precipitation ranges from 18 to 30 inches.

Most of the soils above 4,600 feet formed in material derived from basalt buried by a 20- to 40-inch overlay of volcanic ash. This ash originated from volcanic eruptions of Mt. Mazama in the Cascade Range (*4*). An example is the Helter soil.

Relief plays an important role in the deposition of the ash in areas where the fall was minimal. In these areas the ash accumulated almost exclusively on north-facing slopes, mainly below elevations of 4,600 feet. The Tolo soil is an example. Because of deposition of the volcanic ash in the Recent geologic period, about 6,500 years ago, there has been little soil development (*4*).

Small amounts of volcanic ash accumulated in depressions and along drainageways throughout the forest. These areas have a high water table. In places where there is a large influence of ash, Aquepts formed. In other areas, particularly along streams, the deposited ash was removed by water and thus did not influence the development of the soil profile. Aquolls are examples of such soils. Both Aquolls and Aquepts, formed under a grass-sedge vegetation, have a very dark, well structured surface horizon.

Most of the soils on south-facing slopes, particularly below 4,600 feet elevation, are derived from clayey sediments, granodiorite, and basalt and other basic igneous rocks. Because of their south or southwest aspect, they did not receive deposits of volcanic ash. Thus, soil development was not interrupted. Klicker and Hankins soils, for example, formed a distinct, well structured argillic horizon.

Soils derived from granodiorite do not show much development, mainly because of the slow weathering of the parent material. An example is the Labuck soil.

The nontimbered soils on the flats and steep breaks near the North Fork John Day River are shallow. They received little volcanic ash from the Cascades or loess from glacial outwash areas, mainly along the Columbia River. Because they are shallow and have a high content of rock fragments, little plant cover was established, resulting in little soil development. Such soils are the Bocker and Gwin soils.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Consumptive use. The quantity of water used and transpired by vegetation plus that evaporated.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Depth to rock. Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Center-pivot.—An automatically rotating sprinkler pipe, or boom, that supplies water to the sprinkler heads or nozzles from the center or pivot point of the system.

Hand line.—A sprinkler system in which the pipes containing the sprinkler heads are carried by hand to each new setting.

Wheel line.—A sprinkler system in which the pipes containing the sprinkler heads are supported on wheels and are rolled to each new setting.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil and support little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the low lands along streams.

Water supplying capacity. Water stored in the soil at the beginning of plant growth in spring, plus rainfall during the growing season, less evaporation and runoff.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent.—A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian.—A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched.—A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-73]

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days[1]	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
					Arlington, Oregon						
January-----	41.5	27.7	34.6	61	-2	115	1.60	.73	2.30	5	4.6
February---	49.6	32.2	40.9	68	12	101	.94	.23	1.49	3	.9
March------	57.1	34.7	45.9	74	16	194	.76	.30	1.13	3	.3
April------	65.9	39.8	52.8	84	24	384	.49	.10	.79	2	.0
May--------	76.4	47.3	61.9	97	31	679	.56	.19	.86	2	.0
June-------	83.6	54.6	69.1	104	41	873	.45	.09	.72	1	.0
July-------	92.3	60.4	76.4	109	46	1,128	.20	.00	.36	1	.0
August-----	90.1	59.5	74.8	107	46	1,079	.17	.00	.31	1	.0
September--	81.1	51.0	66.1	98	34	783	.44	.14	.67	1	.0
October----	66.5	41.7	54.1	84	23	437	.57	.21	.85	2	.0
November---	50.7	33.7	42.2	66	13	142	1.38	.57	2.03	5	.5
December---	42.6	29.6	36.2	61	6	57	1.66	.75	2.39	6	3.1
Year-------	66.5	42.7	54.6	109	-8	5,972	9.22	7.53	10.82	32	9.4

See footnote at end of table.

TABLE 1.--TEMPERATURE AND PRECIPITATION--Continued

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have--		Average number of growing degree days[1]	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
	°F	°F	°F	°F	°F	Units	In	In	In		In
Heppner, Oregon											
January----	42.1	26.0	34.0	65	-5	97	1.49	.83	2.02	5	6.2
February---	48.0	29.9	38.9	68	9	83	1.06	.51	1.49	4	2.7
March------	52.8	31.6	42.2	72	17	111	1.31	.75	1.76	4	1.5
April------	59.9	35.3	47.6	80	22	234	1.08	.39	1.61	4	.5
May--------	68.7	41.8	55.3	89	29	474	1.48	.58	2.20	4	.0
June-------	76.7	47.9	62.3	95	35	669	1.07	.40	1.61	3	.0
July-------	85.5	52.0	68.8	102	39	893	.35	.03	.59	1	.0
August-----	83.8	51.6	67.7	101	39	859	.54	.04	.91	2	.0
September--	75.7	45.8	60.8	95	31	624	.77	.24	1.19	2	.0
October----	64.0	38.4	51.2	83	23	347	1.13	.53	1.61	4	.2
November---	50.6	31.8	41.3	71	12	122	1.60	.74	2.28	5	1.4
December---	43.6	27.5	35.6	64	2	51	1.67	.85	2.34	6	4.0
Year-------	62.6	38.3	50.5	103	-12	4,564	13.55	11.65	15.37	44	16.5

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[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-73]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Arlington, Oregon			
Last freezing temperature in spring:			
1 year in 10 later than--	April 11	April 26	May 11
2 years in 10 later than--	April 1	April 19	May 5
5 years in 10 later than--	March 14	April 7	April 24
First freezing temperature in fall:			
1 year in 10 earlier than--	October 15	October 15	September 21
2 years in 10 earlier than--	October 23	October 21	September 29
5 years in 10 earlier than--	November 16	November 3	October 13
Heppner, Oregon			
Last freezing temperature in spring:			
1 year in 10 later than--	April 25	May 8	May 30
2 years in 10 later than--	April 16	May 2	May 25
5 years in 10 later than--	March 29	April 20	May 14
First freezing temperature in fall:			
1 year in 10 earlier than--	October 19	September 30	September 19
2 years in 10 earlier than--	October 27	October 7	September 24
5 years in 10 earlier than--	November 11	October 21	October 4

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-73]

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
Arlington, Oregon			
9 years in 10	200	185	143
8 years in 10	216	194	153
5 years in 10	246	209	171
2 years in 10	277	225	189
1 year in 10	293	234	198
Heppner, Oregon			
9 years in 10	198	154	123
8 years in 10	207	164	129
5 years in 10	226	183	142
2 years in 10	244	203	155
1 year in 10	253	213	162

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Aquepts and Aquolls, nearly level	4,898	0.4
2D	Bakeoven very cobbly loam, 2 to 20 percent slopes	3,374	0.3
3D	Bakeoven-Morrow complex, 2 to 20 percent slopes	31,822	2.4
4D	Bakeoven-Valby complex, 2 to 20 percent slopes	14,603	1.1
5E	Boardtree loam, 7 to 40 percent slopes	14,340	1.1
6C	Bocker extremely cobbly silt loam, 2 to 12 percent slopes	11,068	0.8
7C	Bocker-Wrightman complex, 2 to 12 percent slopes	12,818	1.0
8B	Burbank loamy fine sand, 2 to 5 percent slopes	4,523	0.3
8C	Burbank loamy fine sand, 5 to 12 percent slopes	252	*
9	Dune land	6,858	0.5
10B	Ellum fine sandy loam, 2 to 5 percent slopes	1,040	0.1
10C	Ellum fine sandy loam, 5 to 12 percent slopes	978	0.1
11	Endersby fine sandy loam	3,164	0.2
12	Esquatzel silt loam	663	0.1
13D	Gravden very gravelly loam, 5 to 20 percent slopes	960	0.1
13E	Gravden very gravelly loam, 20 to 40 percent slopes	2,756	0.2
14E	Gwin extremely stony silt loam, 12 to 40 percent slopes	1,922	0.1
15F	Gwin-Rock outcrop complex, 40 to 70 percent slopes	8,331	0.6
16C	Hall Ranch loam, 2 to 12 percent slopes	8,736	0.7
17E	Hall Ranch gravelly loam, 12 to 35 percent slopes	16,140	1.2
18E	Hankins silt loam, 5 to 35 percent south slopes	24,307	1.9
19C	Helter silt loam, bedrock substratum, 3 to 15 percent slopes	30,022	2.3
19E	Helter silt loam, bedrock substratum, 15 to 35 percent slopes	28,124	2.1
19F	Helter silt loam, bedrock substratum, 35 to 60 percent slopes	1,736	0.1
20B	Hezel loamy fine sand, 2 to 5 percent slopes	3,133	0.2
20C	Hezel loamy fine sand, 5 to 12 percent slopes	524	*
21B	Irrigon fine sandy loam, 2 to 5 percent slopes	1,383	0.1
21C	Irrigon fine sandy loam, 5 to 12 percent slopes	703	0.1
22	Kimberly fine sandy loam	2,762	0.2
23D	Klicker stony silt loam, 2 to 20 percent slopes	35,406	2.7
24E	Klicker stony silt loam, 20 to 40 percent north slopes	8,307	0.6
24F	Klicker stony silt loam, 40 to 75 percent north slopes	7,180	0.5
25E	Klicker very stony silt loam, 20 to 40 percent south slopes	11,843	0.9
25F	Klicker very stony silt loam, 40 to 75 percent south slopes	970	0.1
26B	Koehler loamy fine sand, 2 to 5 percent slopes	29,203	2.2
26C	Koehler loamy fine sand, 5 to 12 percent slopes	1,834	0.1
27E	Labuck loam, 5 to 35 percent slopes	5,924	0.5
28E	Lickskillet very stony loam, 7 to 40 percent slopes	87,495	6.7
29F	Lickskillet-Rock outcrop complex, 40 to 70 percent slopes	17,303	1.3
30B	Mikkalo silt loam, 2 to 7 percent slopes	20,557	1.6
30C	Mikkalo silt loam, 7 to 12 percent slopes	20,774	1.6
30D	Mikkalo silt loam, 12 to 20 percent slopes	4,094	0.3
31B	Morrow silt loam, 1 to 7 percent slopes	17,707	1.4
31C	Morrow silt loam, 7 to 12 percent slopes	16,948	1.3
32D	Morrow silt loam, 12 to 20 percent north slopes	15,068	1.2
32E	Morrow silt loam, 20 to 35 percent north slopes	21,577	1.6
33D	Morrow silt loam, 12 to 20 percent south slopes	3,255	0.2
33E	Morrow silt loam, 20 to 30 percent south slopes	6,640	0.5
34F	Nansene silt loam, 35 to 70 percent slopes	3,024	0.2
35	Onyx silt loam	3,515	0.3
36	Pedigo silt loam	2,358	0.2
37A	Prosser silt loam, 0 to 2 percent slopes	2,898	0.2
37B	Prosser silt loam, 2 to 7 percent slopes	478	*
38D	Prosser-Rock outcrop complex, 1 to 20 percent slopes	7,861	0.6
39C	Quincy fine sand, 2 to 12 percent slopes	6,759	0.5
40C	Quincy loamy fine sand, 2 to 12 percent slopes	82,852	6.2
41B	Quinton loamy fine sand, 2 to 5 percent slopes	2,982	0.2
42D	Quinton-Rock outcrop complex, 2 to 20 percent slopes	894	0.1
43B	Rhea silt loam, 1 to 7 percent slopes	900	0.1
43C	Rhea silt loam, 7 to 12 percent slopes	6,373	0.5
43D	Rhea silt loam, 12 to 20 percent slopes	7,364	0.6
43E	Rhea silt loam, 20 to 35 percent slopes	7,676	0.6
43F	Rhea silt loam, 35 to 50 percent slopes	7,388	0.6
44B	Ritzville very fine sandy loam, 2 to 7 percent slopes	4,428	0.3
44C	Ritzville very fine sandy loam, 7 to 12 percent slopes	1,024	0.1
44D	Ritzville very fine sandy loam, 12 to 25 percent slopes	309	*
45A	Ritzville silt loam, 0 to 2 percent slopes	6,864	0.5

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
45B	Ritzville silt loam, 2 to 7 percent slopes	74,241	5.7
45C	Ritzville silt loam, 7 to 12 percent slopes	44,026	3.4
45D	Ritzville silt loam, 12 to 20 percent slopes	13,096	1.0
46E	Ritzville silt loam, 20 to 40 percent north slopes	6,987	0.5
47E	Ritzville silt loam, 20 to 40 percent south slopes	1,833	0.1
48	Riverwash	214	*
49F	Rock outcrop-Rubble land complex, very steep	1,153	0.1
50D	Rockly very gravelly loam, 2 to 20 percent slopes	8,069	0.6
51B	Royal loamy fine sand, 2 to 5 percent slopes	3,787	0.3
51C	Royal loamy fine sand, 5 to 12 percent slopes	293	*
52B	Royal fine sandy loam, 2 to 5 percent slopes	579	*
52C	Royal fine sandy loam, 5 to 12 percent slopes	1,046	0.1
52D	Royal fine sandy loam, 12 to 20 percent slopes	464	*
53A	Royal silt loam, 0 to 3 percent slopes	829	0.1
54B	Sagehill fine sandy loam, 2 to 5 percent slopes	16,343	1.2
54C	Sagehill fine sandy loam, 5 to 12 percent slopes	5,604	0.4
54D	Sagehill fine sandy loam, 12 to 20 percent slopes	3,131	0.2
55B	Sagehill fine sandy loam, hummocky, 2 to 5 percent slopes	8,123	0.6
55C	Sagehill fine sandy loam, hummocky, 5 to 12 percent slopes	4,827	0.4
56F	Snell very stony loam, 35 to 70 percent north slopes	5,891	0.4
57	Snow silt loam	2,163	0.2
58A	Taunton fine sandy loam, 0 to 2 percent slopes	1,526	0.1
58B	Taunton fine sandy loam, 2 to 5 percent slopes	7,060	0.5
58C	Taunton fine sandy loam, 5 to 12 percent slopes	1,603	0.1
59B	Taunton fine sandy loam, hummocky, 0 to 5 percent slopes	640	*
60C	Tolo silt loam, 3 to 15 percent slopes	5,387	0.4
60E	Tolo silt loam, 15 to 35 percent slopes	16,795	1.3
60F	Tolo silt loam, 35 to 60 percent slopes	1,989	0.2
61E	Ukiah stony silty clay loam, 5 to 30 percent slopes	1,426	0.1
62D	Utley loam, 8 to 20 percent slopes	541	*
63B	Valby silt loam, 1 to 7 percent slopes	44,005	3.4
63C	Valby silt loam, 7 to 12 percent slopes	33,364	2.5
64D	Valby silt loam, 12 to 20 percent north slopes	14,680	1.1
65D	Valby silt loam, 12 to 20 percent south slopes	3,938	0.3
65E	Valby silt loam, 20 to 30 percent south slopes	5,995	0.5
66B	Waha silt loam, 1 to 7 percent slopes	7,709	0.6
67D	Waha silt loam, 7 to 25 percent north slopes	11,979	0.9
67E	Waha silt loam, 25 to 40 percent north slopes	22,293	1.7
68D	Waha silt loam, 7 to 25 percent south slopes	2,385	0.2
69D	Waha-Rockly complex, 2 to 20 percent slopes	44,990	3.4
70B	Warden very fine sandy loam, 2 to 5 percent slopes	6,190	0.5
70C	Warden very fine sandy loam, 5 to 12 percent slopes	2,315	0.2
70D	Warden very fine sandy loam, 12 to 20 percent slopes	2,431	0.2
71A	Warden silt loam, 0 to 2 percent slopes	3,771	0.3
71B	Warden silt loam, 2 to 5 percent slopes	24,439	1.9
71C	Warden silt loam, 5 to 12 percent slopes	7,023	0.5
71D	Warden silt loam, 12 to 20 percent slopes	5,828	0.4
71E	Warden silt loam, 20 to 40 percent slopes	3,528	0.3
72C	Warden silt loam, 3 to 12 percent slopes, eroded	465	*
72D	Warden silt loam, 12 to 20 percent slopes, eroded	602	*
73E	Waterbury extremely stony silt loam, 7 to 40 percent slopes	37,904	2.9
74F	Waterbury-Rock outcrop complex, 40 to 70 percent slopes	11,034	0.8
75B	Willis silt loam, 2 to 5 percent slopes	14,076	1.1
75C	Willis silt loam, 5 to 12 percent slopes	7,744	0.6
75D	Willis silt loam, 12 to 20 percent slopes	1,443	0.1
76C	Winchester sand, 0 to 12 percent slopes	6,000	0.5
77F	Wrentham-Rock outcrop complex, 35 to 70 percent slopes	11,278	0.9
78	Xeric Torriorthents, nearly level	3,416	0.3
	Water	680	0.1
	Total	1,311,143	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Winter wheat		Barley	Irish potatoes	Alfalfa hay	Pasture		Corn silage
	N	I	N	I	I	N	I	I
	Bu	Bu	Bu	Cwt	Ton	AUM*	AUM*	Ton
8B, 8C Burbank	---	80	---	400	4	---	12	25
9**. Dune land								
11 Endersby	25	100	---	---	4	---	12	---
12 Esquatzel	25	100	---	---	5	---	12	---
20B Hezel	---	100	---	500	5	---	12	30
20C Hezel	---	100	---	500	5	---	12	30
21B Irrigon	---	80	---	400	5	---	12	25
21C Irrigon	---	80	---	400	5	---	12	25
22 Kimberly	---	100	---	---	6	---	16	---
26B, 26C Koehler	---	90	---	500	4	---	12	25
30B Mikkalo	25	---	30	---	---	3	12	---
30C Mikkalo	25	---	30	---	---	3	12	---
30D Mikkalo	25	---	30	---	---	3	12	---
31B, 31C, 32D, 32E, 33D, 33E Morrow	25	---	35	---	---	3	---	---
35 Onyx	35	80	---	---	---	6	18	---
36 Pedigo	25	80	---	---	---	---	---	---
37A Prosser	---	---	---	---	4	---	12	---
37B Prosser	---	---	---	---	4	---	12	---
39C, 40C Quincy	---	100	---	500	6	---	18	30
41B Quinton	---	80	---	400	4	---	12	25

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Winter wheat		Barley	Irish potatoes	Alfalfa hay	Pasture		Corn silage
	N	I	N	I	I	N	I	I
	Bu	Bu	Bu	Cwt	Ton	AUM*	AUM*	Ton
43B Rhea	40	---	40	---	---	3	---	---
43C, 43D Rhea	40	---	40	---	---	3	---	---
43E Rhea	40	---	40	---	---	3	---	---
43F Rhea	---	---	---	---	---	3	---	---
44B Ritzville	25	100	35	---	6	---	---	---
44C, 44D Ritzville	25	100	35	---	6	---	---	---
45A Ritzville	25	100	35	---	6	---	---	---
45B Ritzville	25	100	35	---	6	---	---	---
45C, 45D Ritzville	25	---	35	---	6	---	---	---
46E, 47E Ritzville	20	---	30	---	---	---	---	---
48**. Riverwash								
51B, 51C Royal	---	100	---	500	6	---	18	30
52B, 52C, 52D Royal	---	100	---	500	6	---	18	30
53A Royal	---	100	---	500	6	---	18	---
54B Sagehill	---	100	---	600	7	---	21	30
54C Sagehill	---	100	---	600	7	---	21	30
54D Sagehill	---	100	---	600	7	---	21	30
57 Snow	40	90	---	---	5	3	12	---
58A, 58B, 58C Taunton	---	90	---	400	5	---	15	20
63B Valby	30	---	40	---	---	3	---	---
63C, 64D, 65D Valby	30	---	40	---	---	3	---	---
66B Waha	25	---	35	---	---	3	---	---
67D Waha	25	---	35	---	---	3	---	---

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Winter wheat		Barley	Irish potatoes	Alfalfa hay	Pasture		Corn silage
	N	I	N	I	I	N	I	I
	Bu	Bu	Bu	Cwt	Ton	AUM*	AUM*	Ton
68D----------------------- Waha	15	---	30	---	---	3	---	---
70B----------------------- Warden	20	100	30	500	6	---	---	30
70C----------------------- Warden	20	100	30	500	6	---	---	30
70D----------------------- Warden	20	100	30	500	6	---	---	30
71A----------------------- Warden	20	100	30	500	6	---	---	30
71B----------------------- Warden	20	100	30	500	6	---	---	30
71C----------------------- Warden	20	100	30	500	6	---	---	30
71D----------------------- Warden	20	100	30	500	6	---	---	30
75B----------------------- Willis	20	---	30	---	---	---	---	---
75C----------------------- Willis	20	---	30	---	---	---	---	---
75D----------------------- Willis	20	---	30	---	---	---	---	---
76C----------------------- Winchester	---	100	---	500	6	---	18	30

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
2D	Shrubby Scabland	Favorable	500	Stiff sagebrush	70
Bakeoven		Normal	400	Sandberg bluegrass	20
		Unfavorable	300		
3D*:					
Bakeoven	Shrubby Scabland	Favorable	500	Stiff sagebrush	70
		Normal	400	Sandberg bluegrass	20
		Unfavorable	300		
Morrow	Biscuit	Favorable	900	Bluebunch wheatgrass	45
		Normal	750	Idaho fescue	35
		Unfavorable	400	Sandberg bluegrass	10
4D*:					
Bakeoven	Shrubby Scabland	Favorable	500	Stiff sagebrush	70
		Normal	400	Sandberg bluegrass	20
		Unfavorable	300		
Valby	Biscuit	Favorable	900	Bluebunch wheatgrass	45
		Normal	750	Idaho fescue	35
		Unfavorable	400	Sandberg bluegrass	10
6C	Scabland	Favorable	400	Sandberg bluegrass	80
Bocker		Normal	300	Douglas eriogonum	5
		Unfavorable	200	Bluebunch wheatgrass	5
7C*:					
Bocker	Scabland	Favorable	400	Sandberg bluegrass	80
		Normal	300	Douglas eriogonum	5
		Unfavorable	200	Bluebunch wheatgrass	5
Wrightman	Biscuit (moist)	Favorable	1,500	Idaho fescue	70
		Normal	1,400	Bluebunch wheatgrass	10
		Unfavorable	700	Sandberg bluegrass	5
8B, 8C	Loamy Sand Terrace	Favorable	900	Needleandthread	60
Burbank		Normal	700	Indian ricegrass	20
		Unfavorable	475	Antelope bitterbrush	5
10B, 10C	Light Loamy Terrace	Favorable	900	Needleandthread	55
Ellum		Normal	700	Bluebunch wheatgrass	20
		Unfavorable	300	Indian ricegrass	10
13D	Droughty Rolling Hills	Favorable	700	Bluebunch wheatgrass	65
Gravden		Normal	650	Sandberg bluegrass	25
		Unfavorable	200		
13E	Droughty South Exposure	Favorable	600	Bluebunch wheatgrass	75
Gravden		Normal	400	Sandberg bluegrass	10
		Unfavorable	200	Thurber needlegrass	5
14E	South Exposure	Favorable	1,400	Bluebunch wheatgrass	55
Gwin		Normal	1,300	Idaho fescue	20
		Unfavorable	600	Sandberg bluegrass	10
15F*:					
Gwin	Steep South	Favorable	900	Bluebunch wheatgrass	80
		Normal	750	Sandberg bluegrass	10
		Unfavorable	325		
Rock outcrop.					

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
20B, 20C	Sand Loam Terrace	Favorable	850	Bluebunch wheatgrass	60
Hezel		Normal	700	Sandberg bluegrass	15
		Unfavorable	450	Needleandthread	10
				Big sagebrush	5
21B, 21C	Sand Loam Terrace	Favorable	850	Bluebunch wheatgrass	60
Irrigon		Normal	700	Sandberg bluegrass	15
		Unfavorable	450	Needleandthread	10
				Big sagebrush	5
26B, 26C	Loamy Sand Terrace	Favorable	900	Needleandthread	60
Koehler		Normal	700	Indian ricegrass	20
		Unfavorable	475	Antelope bitterbrush	5
28E	Droughty South Exposure	Favorable	850	Bluebunch wheatgrass	75
Lickskillet		Normal	700	Sandberg bluegrass	10
		Unfavorable	350	Thurber needlegrass	5
				Phlox	5
29F*:					
Lickskillet	Droughty South Exposure	Favorable	850	Bluebunch wheatgrass	75
		Normal	700	Sandberg bluegrass	10
		Unfavorable	350	Thurber needlegrass	5
				Phlox	5
Rock outcrop.					
30B, 30C, 30D	Droughty Rolling Hills	Favorable	700	Bluebunch wheatgrass	65
Mikkalo		Normal	650	Sandberg bluegrass	25
		Unfavorable	200		
31B, 31C	Rolling Hills	Favorable	900	Bluebunch wheatgrass	45
Morrow		Normal	750	Idaho fescue	35
		Unfavorable	400	Sandberg bluegrass	10
32D, 32E	North Exposure	Favorable	1,300	Idaho fescue	70
Morrow		Normal	1,000	Bluebunch wheatgrass	15
		Unfavorable	650	Cusick bluegrass	5
33D, 33E	South Exposure	Favorable	1,400	Bluebunch wheatgrass	55
Morrow		Normal	1,300	Idaho fescue	20
		Unfavorable	600	Sandberg bluegrass	10
34F	North Exposure	Favorable	1,400	Idaho fescue	70
Nansene		Normal	1,300	Bluebunch wheatgrass	15
		Unfavorable	700	Cusick bluegrass	5
37A, 37B	Light Loamy Terrace	Favorable	900	Needleandthread	55
Prosser		Normal	700	Bluebunch wheatgrass	20
		Unfavorable	300	Indian ricegrass	10
38D*:					
Prosser	Light Loamy Terrace	Favorable	900	Needleandthread	55
		Normal	700	Bluebunch wheatgrass	20
		Unfavorable	300	Indian ricegrass	10
Rock outcrop.					
39C, 40C	Loamy Sand Terrace	Favorable	900	Needleandthread	60
Quincy		Normal	700	Indian ricegrass	20
		Unfavorable	475	Antelope bitterbrush	5
41B	Loamy Sand Terrace	Favorable	900	Needleandthread	60
Quinton		Normal	700	Indian ricegrass	20
		Unfavorable	475	Antelope bitterbrush	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
42D*:					
Quinton	Loamy Sand Terrace	Favorable	900	Needleandthread	60
		Normal	700	Indian ricegrass	20
		Unfavorable	475	Antelope bitterbrush	5
Rock outcrop.					
43B, 43C	Rolling Hills	Favorable	1,000	Bluebunch wheatgrass	45
Rhea		Normal	800	Idaho fescue	35
		Unfavorable	350	Sandberg bluegrass	10
43D, 43E	Droughty North Exposure	Favorable	950	Bluebunch wheatgrass	45
Rhea		Normal	800	Idaho fescue	30
		Unfavorable	300	Sandberg bluegrass	10
43F	Steep North	Favorable	1,450	Idaho fescue	70
Rhea		Normal	1,300	Bluebunch wheatgrass	15
		Unfavorable	700	Cusick bluegrass	5
44B, 44C, 44D	Droughty Rolling Hills	Favorable	700	Bluebunch wheatgrass	65
Ritzville		Normal	650	Sandberg bluegrass	25
		Unfavorable	200		
45A	Droughty Rolling Hills	Favorable	700	Bluebunch wheatgrass	65
Ritzville		Normal	650	Sandberg bluegrass	25
		Unfavorable	200		
45B, 45C, 45D	Droughty Rolling Hills	Favorable	700	Bluebunch wheatgrass	65
Ritzville		Normal	650	Sandberg bluegrass	25
		Unfavorable	200		
46E	Droughty North Exposure	Favorable	950	Bluebunch wheatgrass	45
Ritzville		Normal	800	Idaho fescue	30
		Unfavorable	300	Sandberg bluegrass	10
47E	Droughty South Exposure	Favorable	850	Bluebunch wheatgrass	75
Ritzville		Normal	700	Sandberg bluegrass	10
		Unfavorable	350	Thurber needlegrass	5
50D	Scabland	Favorable	400	Sandberg bluegrass	80
Rockly		Normal	350	Bluebunch wheatgrass	5
		Unfavorable	150		
51B, 51C	Light Loamy Terrace	Favorable	900	Needleandthread	55
Royal		Normal	700	Bluebunch wheatgrass	20
		Unfavorable	300	Indian ricegrass	10
52B, 52C, 52D, 53A	Light Loamy Terrace	Favorable	900	Needleandthread	55
Royal		Normal	700	Bluebunch wheatgrass	20
		Unfavorable	300	Indian ricegrass	10
54B, 54C, 54D, 55B, 55C	Sand Loam Terrace	Favorable	850	Bluebunch wheatgrass	60
Sagehill		Normal	700	Sandberg bluegrass	15
		Unfavorable	450	Needleandthread	10
56F	North Exposure	Favorable	1,450	Idaho fescue	70
Snell		Normal	1,300	Bluebunch wheatgrass	15
		Unfavorable	700	Cusick bluegrass	5
58A, 58B, 58C, 59B	Light Loamy Terrace	Favorable	900	Needleandthread	55
Taunton		Normal	700	Bluebunch wheatgrass	20
		Unfavorable	300	Indian ricegrass	10
61E	South Exposure	Favorable	1,300	Bluebunch wheatgrass	55
Ukiah		Normal	1,200	Idaho fescue	20
		Unfavorable	550	Sandberg bluegrass	10

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
62D Utley	Moist Rolling Hills	Favorable	1,500	Idaho fescue	70
		Normal	1,400	Bluebunch wheatgrass	10
		Unfavorable	700	Sandberg bluegrass	5
63B, 63C Valby	Rolling Hills	Favorable	1,000	Bluebunch wheatgrass	65
		Normal	800	Idaho fescue	20
		Unfavorable	350	Sandberg bluegrass	10
64D Valby	Droughty North Exposure	Favorable	950	Bluebunch wheatgrass	45
		Normal	800	Idaho fescue	20
		Unfavorable	300	Sandberg bluegrass	10
65D, 65E Valby	Droughty South Exposure	Favorable	850	Bluebunch wheatgrass	75
		Normal	700	Sandberg bluegrass	10
		Unfavorable	350	Thurber needlegrass	5
66B Waha	Moist Rolling Hills	Favorable	1,500	Idaho fescue	70
		Normal	1,400	Bluebunch wheatgrass	10
		Unfavorable	700	Sandberg bluegrass	5
67D, 67E Waha	North Exposure	Favorable	1,300	Idaho fescue	70
		Normal	1,000	Bluebunch wheatgrass	15
		Unfavorable	650	Cusick bluegrass	5
68D Waha	South Exposure	Favorable	1,400	Bluebunch wheatgrass	55
		Normal	1,300	Idaho fescue	20
		Unfavorable	600	Sandberg bluegrass	10
69D*:					
Waha	Biscuit (moist)	Favorable	1,500	Idaho fescue	70
		Normal	1,400	Bluebunch wheatgrass	10
		Unfavorable	700	Sandberg bluegrass	5
Rockly	Scabland	Favorable	400	Sandberg bluegrass	80
		Normal	350	Bluebunch wheatgrass	5
		Unfavorable	150		
70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72C, 72D Warden	Silty Terrace	Favorable	650	Bluebunch wheatgrass	70
		Normal	500	Sandberg bluegrass	20
		Unfavorable	200		
73E Waterbury	South Exposure	Favorable	1,400	Bluebunch wheatgrass	55
		Normal	1,300	Idaho fescue	20
		Unfavorable	600	Sandberg bluegrass	10
74F*:					
Waterbury	Droughty South Exposure	Favorable	700	Bluebunch wheatgrass	80
		Normal	600	Sandberg bluegrass	10
		Unfavorable	250	Thurber needlegrass	5
Rock outcrop.					
75B, 75C, 75D Willis	Droughty Rolling Hills	Favorable	700	Bluebunch wheatgrass	65
		Normal	650	Sandberg bluegrass	25
		Unfavorable	200		
76C Winchester	Sand Terrace	Favorable	600	Indian ricegrass	45
		Normal	450	Antelope bitterbrush	20
		Unfavorable	250	Yellow wildrye	10
				Buckwheat	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
77F*:					
Wrentham	North Exposure	Favorable	1,450	Idaho fescue	70
		Normal	1,300	Bluebunch wheatgrass	15
		Unfavorable	700	Sandberg bluegrass	5
Rock outcrop.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
5E Boardtree	3r	Moderate	Slight	Slight	Moderate	Douglas-fir	70	Douglas-fir, ponderosa pine.
16C, 17E Hall Ranch	3o	Slight	Slight	Slight	Slight	Douglas-fir	66	Douglas-fir, ponderosa pine.
						Ponderosa pine	79	
						Douglas-fir	---	
18E Hankins	4o	Moderate	Moderate	Slight	Slight	Ponderosa pine	71	Ponderosa pine.
19C, 19E Helter	2o	Moderate	Slight	Slight	Moderate	Western larch	60	Douglas-fir.
						Douglas-fir	78	
						Grand fir	---	
						Lodgepole pine	80	
19F Helter	2r	Severe	Slight	Slight	Moderate	Western larch	60	Douglas-fir.
						Douglas-fir	78	
						Grand fir	---	
						Lodgepole pine	80	
23D Klicker	5o	Moderate	Severe	Moderate	Slight	Ponderosa pine	68	Ponderosa pine.
24E Klicker	4o	Moderate	Moderate	Moderate	Moderate	Ponderosa pine	79	Ponderosa pine, Douglas-fir.
						Douglas-fir	---	
24F Klicker	4r	Severe	Moderate	Moderate	Moderate	Ponderosa pine	79	Ponderosa pine, Douglas-fir.
						Douglas-for	---	
25E Klicker	5o	Moderate	Severe	Moderate	Slight	Ponderosa pine	68	Ponderosa pine.
						Douglas-fir	---	
25F Klicker	5r	Severe	Severe	Moderate	Slight	Ponderosa pine	68	Ponderosa pine.
						Douglas-fir	---	
27E Labuck	5o	Slight	Moderate	Moderate	Slight	Ponderosa pine	61	Ponderosa pine.
						Douglas-fir	56	
60C, 60E Tolo	2o	Slight	Slight	Slight	Slight	Douglas-fir	76	Douglas-fir.
						Western larch	---	
						Grand fir	---	
						Lodgepole pine	---	
						Ponderosa pine	100	
60F Tolo	2r	Severe	Slight	Slight	Slight	Douglas-fir	76	Douglas-fir.
						Western larch	---	
						Grand fir	---	
						Lodgepole pine	---	
						Ponderosa pine	100	

TABLE 8.--WOODLAND UNDERSTORY VEGETATION

[Only the soils suitable for production of commercial trees are listed]

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
5E	Favorable	900	Pinegrass	55
Boardtree	Normal	800	Elk sedge	25
	Unfavorable	650	Peavine	5
16C, 17E	Favorable	900	Pinegrass	55
Hall Ranch	Normal	800	Elk sedge	25
	Unfavorable	650	Peavine	5
18E	Favorable	900	Elksedge	45
Hankins	Normal	750	Pinegrass	20
	Unfavorable	450	Idaho fescue	5
19C, 19E, 19F	Favorable	---	Bearberry	5
Helter	Normal	---	Pinegrass	5
	Unfavorable	---	Peavine	5
23D	Favorable	1,700	Idaho fescue	45
Klicker	Normal	1,400	Bluebunch wheatgrass	20
	Unfavorable	750	Sandberg bluegrass	5
24E, 24F	Favorable	---	Elk sedge	40
Klicker	Normal	---	Pinegrass	10
	Unfavorable	---	Peavine	5
25E, 25F	Favorable	1,700	Idaho fescue	45
Klicker	Normal	1,400	Bluebunch wheatgrass	20
	Unfavorable	750	Sandberg bluegrass	5
27E	Favorable	875	Elk sedge	40
Labuck	Normal	700	Pinegrass	10
	Unfavorable	450	Idaho fescue	5
			Bearberry	5
60C, 60E, 60F	Favorable	---	Common snowberry	15
Tolo	Normal	---	Elk sedge	10
	Unfavorable	---	Pinegrass	5
			Bearberry	5
			Peavine	5

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
8E, 8C Burbank	---	---	Russian-olive	Black locust	Idahybrid poplar.
10B, 10C Ellum	---	Russian-olive	Black locust	---	---
20B, 20C Hezel	---	Siberian peashrub, Nanking cherry, northern whitecedar, multiflora rose.	Russian-olive	Austrian pine, ponderosa pine, scotch pine, Douglas-fir, green ash, blue spruce.	Idahybrid poplar.
21B, 21C Irrigon	---	Russian-olive	Black locust	---	---
39C, 40C Quincy	---	Siberian peashrub, Nanking cherry, multiflora rose.	Russian-olive	Austrian pine, ponderosa pine, scotch pine, Douglas-fir, green ash.	Lombardy poplar.
41B Quinton	---	Siberian peashrub, Nanking cherry, multiflora rose.	Russian-olive	Black locust, Russian mulberry.	Idahybrid poplar.
42D*: Quinton	---	Siberian peashrub, Nanking cherry, multiflora rose.	Russian-olive	Black locust, Russian mulberry.	Idahybrid poplar.
Rock outcrop.					
44B, 44C, 44D, 45A, 45B, 45C, 45D, 46E, 47E Ritzville	Lilac	Green ash, Rocky Mountain juniper, Siberian peashrub, Russian-olive.	Black locust	---	---
51B, 51C, 52B, 52C, 52D, 53A Royal	---	---	Black locust	Russian mulberry	Idahybrid poplar.
54B, 54C, 54D, 55B, 55C Sagehill	---	---	Black locust	Russian mulberry	Idahybrid poplar.
58A, 58B, 58C, 59B Taunton	---	---	---	Black locust, Russian mulberry.	Idahybrid poplar.
76C Winchester	---	Siberian peashrub, Nanking cherry, northern whitecedar, multiflora rose.	Russian-olive	Austrian pine, ponderosa pine, scotch pine, Douglas-fir, green ash, blue spruce.	Lombardy poplar.

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* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1*:					
Aquepts.					
Aquolls.					
2D Bakeoven	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
3D*:					
Bakeoven	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
Morrow	Severe: depth to rock.	Moderate: slope, depth to rock, shrink-swell.	Severe: depth to rock.	Severe: slope.	Severe: frost action.
4D*:					
Bakeoven	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
Valby	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: frost action.
5E Boardtree	Severe: slope.	Severe: shrink-swell, low strength, slope.	Severe: slope, shrink-swell, low strength.	Severe: shrink-swell, slope, low strength.	Severe: low strength, slope, shrink-swell.
6C Bocker	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
7C*:					
Bocker	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Wrightman	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, frost action, low strength.
8B Burbank	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
8C Burbank	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
9*. Dune land					
10B Ellum	Moderate: cemented pan.	Slight	Moderate: cemented pan.	Slight	Moderate: frost action.
10C Ellum	Moderate: slope, cemented pan.	Moderate: slope.	Moderate: slope, cemented pan.	Severe: slope.	Moderate: slope, frost action.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
11 Endersby	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength, frost action.
12 Esquatzel	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
13D Gravden	Severe: cemented pan.	Moderate: slope, cemented pan.	Severe: cemented pan.	Severe: slope.	Moderate: slope, frost action, cemented pan.
13E Gravden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
14E Gwin	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.
15F*:					
Gwin	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.
Rock outcrop.					
16C Hall Ranch	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength, frost action.
17E Hall Ranch	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
18E Hankins	Severe: slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.
19C Helter	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Severe: frost action.
19E, 19F Helter	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, slope.
20B Hezel	Slight	Slight	Slight	Slight	Moderate: low strength.
20C Hezel	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength.
21B Irrigon	Moderate: depth to rock.	Moderate: low strength.	Moderate: depth to rock, low strength.	Moderate: low strength.	Moderate: low strength, frost action.
21C Irrigon	Moderate: slope, depth to rock.	Moderate: slope, low strength.	Moderate: slope, depth to rock, low strength.	Severe: slope.	Moderate: slope, frost action, low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
22---------------- Kimberly	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
23D--------------- Klicker	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.
24E, 24F, 25E, 25F-------------- Klicker	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.
26B--------------- Koehler	Severe: cutbanks cave.	Slight-----------	Moderate: cemented pan.	Slight------------	Slight.
26C--------------- Koehler	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope, cemented pan.	Severe: slope.	Moderate: slope.
27E--------------- Labuck	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
28E--------------- Lickskillet	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.
29F*: Lickskillet------	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.
Rock outcrop.					
30B--------------- Mikkalo	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, low strength.
30C--------------- Mikkalo	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, low strength, slope.
30D--------------- Mikkalo	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
31B--------------- Morrow	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: slope, depth to rock, shrink-swell.	Severe: frost action.
31C--------------- Morrow	Severe: depth to rock.	Moderate: slope, depth to rock, shrink-swell.	Severe: depth to rock.	Severe: slope.	Severe: frost action.
32D, 32E, 33D, 33E-------------- Morrow	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, frost action.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
34F Nansene	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
35 Onyx	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Severe: frost action.
36 Pedigo	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: frost action.
37A Prosser	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, frost action, low strength.
37B Prosser	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, frost action, low strength.
38D*:					
Prosser	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock, frost action.
Rock outcrop.					
39C, 40C Quincy	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
41B Quinton	Severe: depth to rock, cutbanks cave.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
42D*:					
Quinton	Severe: depth to rock, cutbanks cave.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.
Rock outcrop.					
43B Rhea	Slight	Slight	Slight	Moderate: slope.	Severe: frost action.
43C Rhea	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.
43D, 43E, 43F Rhea	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
44B Ritzville	Slight	Slight	Slight	Moderate: slope.	Severe: frost action.
44C Ritzville	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.
44D Ritzville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
45A Ritzville	Slight	Slight	Slight	Slight	Severe: frost action.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
45B Ritzville	Slight	Slight	Slight	Moderate: slope.	Severe: frost action.
45C Ritzville	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.
45D, 46E, 47E Ritzville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
48*. Riverwash					
49F*:					
Rock outcrop.					
Rubble land.					
50D Rockly	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
51B Royal	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
51C Royal	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, slope.
52B Royal	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
52C Royal	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, slope.
52D Royal	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
53A Royal	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
54B Sagehill	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.
54C Sagehill	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.
54D Sagehill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
55B Sagehill	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.
55C Sagehill	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
56F Snell	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, depth to rock, shrink-swell.	Severe: shrink-swell, low strength, slope.	Severe: slope, shrink-swell.
57 Snow	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Severe: frost action.
58A, 58B Taunton	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.
58C Taunton	Severe: cemented pan.	Moderate: slope, cemented pan.	Severe: cemented pan.	Severe: slope.	Moderate: slope, cemented pan.
59B Taunton	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.
60C Tolo	Moderate: slope.	Moderate: slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: frost action.
60E, 60F Tolo	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
61E Ukiah	Severe: slope, depth to rock.	Severe: slope, low strength, shrink-swell.	Severe: slope, depth to rock, low strength.	Severe: slope, depth to rock, low strength.	Severe: slope, low strength, shrink-swell.
62D Utley	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, low strength.
63B Valby	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: frost action.
63C Valby	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: frost action.
64D, 65D, 65E Valby	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, frost action.
66B Waha	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Moderate: depth to rock, low strength, frost action.
67D, 67E, 68D Waha	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
69D*:					
Waha	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock, frost action.
Rockly	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
70B--------------- Warden	Slight-----------	Slight-----------	Slight-----------	Slight------------	Moderate: low strength, frost action.
70C--------------- Warden	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength, frost action.
70D--------------- Warden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
71A, 71B---------- Warden	Slight-----------	Slight-----------	Slight-----------	Slight------------	Moderate: low strength, frost action.
71C--------------- Warden	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength, frost action.
71D, 71E---------- Warden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
72C--------------- Warden	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Moderate: low strength, frost action.
72D--------------- Warden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
73E--------------- Waterbury	Severe: depth to rock, large stones, slope.	Severe: large stones, shrink-swell, slope.	Severe: depth to rock, shrink-swell, slope.	Severe: depth to rock, shrink-swell, slope.	Severe: depth to rock, shrink-swell, slope.
74F*:					
Waterbury---------	Severe: depth to rock, large stones, slope.	Severe: large stones, shrink-swell, slope.	Severe: depth to rock, shrink-swell, slope.	Severe: depth to rock, shrink-swell, slope.	Severe: depth to rock, shrink-swell, slope.
Rock outcrop.					
75B--------------- Willis	Moderate: cemented pan.	Slight-----------	Moderate: cemented pan.	Slight------------	Moderate: low strength, frost action.
75C--------------- Willis	Moderate: cemented pan, slope.	Moderate: slope.	Moderate: cemented pan, slope.	Severe: slope.	Moderate: slope, low strength, frost action.
75D--------------- Willis	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
76B--------------- Winchester	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Slight.
77F*:					
Wrentham----------	Severe: slope, depth to rock, large stones.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, large stones.
Rock outcrop.					

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
78*. Xeric Torriorthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1*:					
Aquepts.					
Aquolls.					
2D------------------ Bakeoven	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, small stones, area reclaim.
3D*:					
Bakeoven-----------	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, small stones, area reclaim.
Morrow-------------	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
4D*:					
Bakeoven-----------	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, small stones, area reclaim.
Valby--------------	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
5E------------------ Boardtree	Severe: slope, percs slowly.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: slope, too clayey.
6C------------------ Bocker	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Slight-----------	Poor: thin layer, small stones, area reclaim.
7C*:					
Bocker-------------	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Slight-----------	Poor: thin layer, small stones, area reclaim.
Wrightman----------	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Slight-----------	Fair: thin layer.
8B------------------ Burbank	Slight-----------	Severe: seepage.	Severe: too sandy.	Slight-----------	Poor: seepage, too sandy, small stones.
8C------------------ Burbank	Moderate: slope.	Severe: slope, seepage.	Severe: too sandy.	Moderate: slope.	Poor: seepage, too sandy, small stones.
9*. Dune land					

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
10B----------------- Ellum	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight-----------	Poor: thin layer, area reclaim.
10C----------------- Ellum	Severe: cemented pan.	Severe: slope, cemented pan.	Severe: cemented pan.	Slight-----------	Poor: thin layer, area reclaim.
11------------------ Endersby	Moderate: floods.	Severe: seepage, floods.	Severe: seepage.	Severe: seepage.	Good.
12------------------ Esquatzel	Moderate: floods.	Severe: floods.	Moderate: floods.	Moderate: floods.	Good.
13D----------------- Gravden	Severe: cemented pan.	Severe: slope, cemented pan.	Severe: cemented pan.	Moderate: slope.	Poor: thin layer.
13E----------------- Gravden	Severe: slope, cemented pan.	Severe: slope, cemented pan.	Severe: slope, cemented pan.	Severe: slope.	Poor: slope, thin layer.
14E----------------- Gwin	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope.	Poor: slope, thin layer, large stones.
15F*:					
Gwin----------------	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope.	Poor: slope, thin layer, large stones.
Rock outcrop.					
16C----------------- Hall Ranch	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Slight-----------	Poor: thin layer, area reclaim.
17E----------------- Hall Ranch	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, area reclaim, slope.
18E----------------- Hankins	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: too clayey, slope.
19C----------------- Helter	Severe: percs slowly, depth to rock.	Severe: slope.	Severe: depth to rock.	Moderate: slope.	Fair: thin layer, area reclaim, slope.
19E, 19F------------ Helter	Severe: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
20B----------------- Hezel	Severe: percs slowly.	Severe: seepage.	Slight-----------	Slight-----------	Good.
20C----------------- Hezel	Severe: percs slowly.	Severe: slope, seepage.	Slight-----------	Moderate: slope.	Fair: slope.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
21B Irrigon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer.
21C Irrigon	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Fair: slope, thin layer.
22 Kimberly	Moderate: floods.	Severe: floods, seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
23D Klicker	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
24E, 24F, 25E, 25F Klicker	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: thin layer, area reclaim, slope.
26B Koehler	Severe: cemented pan.	Severe: cemented pan, seepage.	Severe: cemented pan.	Slight	Fair: too sandy, thin layer.
26C Koehler	Severe: cemented pan.	Severe: cemented pan, seepage, slope.	Severe: cemented pan.	Moderate: slope.	Fair: slope, too sandy, thin layer.
27E Labuck	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, area reclaim, slope.
28E Lickskillet	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: slope.	Poor: slope, large stones, thin layer.
29F*: Lickskillet	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope.	Poor: slope, large stones, thin layer.
Rock outcrop.					
30B Mikkalo	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
30C Mikkalo	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
30D Mikkalo	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, area reclaim, slope.
31B Morrow	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
31C Morrow	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: slope, thin layer, area reclaim.
32D Morrow	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
32E Morrow	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
33D Morrow	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
33E Morrow	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
34F Nansene	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope.
35 Onyx	Moderate: floods, percs slowly.	Severe: floods.	Moderate: floods.	Moderate: floods.	Good.
36 Pedigo	Moderate: floods, wetness.	Severe: floods.	Severe: wetness.	Moderate: floods, wetness.	Fair: wetness.
37A, 37B Prosser	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
38D*:					
Prosser	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.
Rock outcrop.					
39C, 40C Quincy	Slight	Severe: slope, seepage.	Severe: too sandy.	Severe: seepage.	Poor: too sandy.
41B Quinton	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock.	Severe: seepage.	Poor: thin layer, too sandy.
42D*:					
Quinton	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock.	Severe: seepage.	Poor: thin layer, too sandy.
Rock outcrop.					
43B Rhea	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
43C Rhea	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
43D Rhea	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
43E, 43F Rhea	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
44B Ritzville	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
44C Ritzville	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
44D Ritzville	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
45A Ritzville	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
45B Ritzville	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
45C Ritzville	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
45D Ritzville	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
46E, 47E Ritzville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
48*. Riverwash					
49F*: Rock outcrop.					
Rubble land.					
50D Rockly	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, small stones, area reclaim.
51B Royal	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
51C Royal	Moderate: slope.	Severe: seepage, slope.	Moderate: too sandy.	Moderate: slope.	Fair: slope, too sandy.
52B Royal	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
52C Royal	Moderate: slope.	Severe: seepage, slope.	Moderate: too sandy.	Moderate: slope.	Fair: slope, too sandy.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
52D Royal	Severe: slope.	Severe: seepage, slope.	Moderate: slope, too sandy.	Severe: slope.	Poor: slope.
53A Royal	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
54B Sagehill	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
54C Sagehill	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
54D Sagehill	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
55B Sagehill	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
55C Sagehill	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
56F Snell	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, large stones, thin layer.
57 Snow	Moderate: floods.	Severe: floods.	Moderate: floods.	Moderate: floods.	Good.
58A, 58B Taunton	Severe: cemented pan.	Severe: cemented pan, seepage.	Severe: cemented pan.	Slight	Poor: thin layer.
58C Taunton	Severe: cemented pan.	Severe: slope, seepage, cemented pan.	Severe: cemented pan.	Moderate: slope.	Poor: thin layer.
59B Taunton	Severe: cemented pan.	Severe: cemented pan, seepage.	Severe: cemented pan.	Slight	Poor: thin layer.
60C Tolo	Severe: percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
60E, 60F Tolo	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
61E Ukiah	Severe: depth to rock, percs slowly, slope.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: slope, thin layer, area reclaim.
62D Utley	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope, small stones.
63B Valby	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
63C Valby	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
64D, 65D Valby	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
65E Valby	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
66B Waha	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
67D Waha	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
67E Waha	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
68D Waha	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
69D*:					
Waha	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, too clayey.
Rockly	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, small stones, area reclaim.
70B Warden	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
70C Warden	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
70D Warden	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
71A Warden	Slight	Moderate: seepage.	Slight	Slight	Good.
71B Warden	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
71C Warden	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
71D Warden	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
71E Warden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
72C Warden	Slight	Severe: slope.	Slight	Slight	Good.
72D Warden	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
73E Waterbury	Severe: depth to rock, slope, percs slowly.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: slope.	Poor: thin layer, large stones, slope.
74F*: Waterbury	Severe: depth to rock, slope, percs slowly.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope.	Poor: thin layer, large stones, slope.
Rock outcrop.					
75B Willis	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer, area reclaim.
75C Willis	Severe: cemented pan.	Severe: slope, cemented pan.	Severe: cemented pan.	Moderate: slope.	Poor: thin layer, area reclaim.
75D Willis	Severe: cemented pan.	Severe: slope, cemented pan.	Severe: cemented pan.	Severe: slope.	Poor: slope, thin layer, area reclaim.
76B Winchester	Slight	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
77F*: Wrentham	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope.	Poor: slope, large stones, thin layer.
Rock outcrop.					
78*. Xeric Torriorthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1*:				
Aquepts.				
Aquolls.				
2D Bakeoven	Poor: area reclaim, thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: thin layer, large stones, area reclaim.
3D*:				
Bakeoven	Poor: area reclaim, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
Morrow	Poor: thin layer, frost action.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: slope, too clayey, thin layer.
4D*:				
Bakeoven	Poor: area reclaim, thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: thin layer, large stones, area reclaim.
Valby	Poor: area reclaim, frost action, thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: slope, thin layer, area reclaim.
5E Boardtree	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
6C Bocker	Poor: thin layer, area reclaim.	Unsuited: thin layer.	Unsuited: thin layer.	Poor: thin layer, small stones, area reclaim.
7C*:				
Bocker	Poor: thin layer, area reclaim.	Unsuited: thin layer.	Unsuited: thin layer.	Poor: thin layer, small stones, area reclaim.
Wrightman	Fair: thin layer, low strength, frost action.	Unsuited: thin layer.	Unsuited: thin layer.	Fair: thin layer, area reclaim.
8B, 8C Burbank	Good	Fair: small stones.	Good	Poor: too sandy, small stones.
9*. Dune land				
10B, 10C Ellum	Poor: thin layer.	Poor: excess fines.	Poor: thin layer.	Poor: thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
11-------------------- Endersby	Fair: low strength, frost action.	Poor: excess fines.	Poor: excess fines.	Good.
12-------------------- Esquatzel	Fair: frost action, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
13D------------------- Gravden	Poor: area reclaim, thin layer.	Unsuited: excess fines.	Unsuited: thin layer.	Poor: thin layer, small stones.
13E------------------- Gravden	Poor: slope, area reclaim, thin layer.	Unsuited: excess fines.	Unsuited: thin layer.	Poor: slope, thin layer, small stones.
14E------------------- Gwin	Poor: thin layer, large stones, slope.	Unsuited: thin layer.	Unsuited: large stones, thin layer.	Poor: thin layer, large stones, slope.
15F*:				
Gwin-----------------	Poor: thin layer, large stones, slope.	Unsuited: thin layer.	Unsuited: large stones, thin layer.	Poor: thin layer, large stones, slope.
Rock outcrop.				
16C------------------- Hall Ranch	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones, area reclaim.
17E------------------- Hall Ranch	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones, slope.
18E------------------- Hankins	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
19C------------------- Helter	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
19E, 19F-------------- Helter	Poor: slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
20B------------------- Hezel	Fair: low strength.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
20C------------------- Hezel	Fair: low strength.	Poor: thin layer.	Unsuited: excess fines.	Fair: slope, too sandy.
21B------------------- Irrigon	Poor: thin layer.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
21C------------------- Irrigon	Poor: thin layer.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
22-------------------- Kimberly	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
23D------------------- Klicker	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
24E, 24F, 25E, 25F---- Klicker	Poor: thin layer, area reclaim, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones, slope.
26B, 26C-------------- Koehler	Poor: thin layer.	Unsuited: thin layer.	Unsuited: excess fines.	Fair: thin layer, too sandy.
27E------------------- Labuck	Poor: thin layer, area reclaim.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: slope.
28E------------------- Lickskillet	Poor: large stones, thin layer, area reclaim.	Unsuited: excess fines, thin layer.	Unsuited: thin layer, excess fines.	Poor: thin layer, area reclaim, large stones.
29F*:				
Lickskillet-----------	Poor: slope, large stones, thin layer.	Unsuited: excess fines, thin layer.	Unsuited: thin layer, excess fines.	Poor: thin layer, area reclaim, large stones.
Rock outcrop.				
30B------------------- Mikkalo	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.
30C------------------- Mikkalo	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim, slope.
30D------------------- Mikkalo	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
31B------------------- Morrow	Poor: thin layer, frost action, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, thin layer.
31C------------------- Morrow	Poor: thin layer, frost action, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, too clayey, thin layer.
32D------------------- Morrow	Poor: thin layer, frost action, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
32E------------------- Morrow	Poor: slope, thin layer, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
33D------------------- Morrow	Poor: thin layer, frost action, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
33E Morrow	Poor: slope, thin layer, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
34F Nansene	Poor: slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
35 Onyx	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
36 Pedigo	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
37A, 37B Prosser	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
38D*:				
Prosser	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
Rock outcrop.				
39C, 40C Quincy	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
41B Quinton	Poor: thin layer.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer, too sandy.
42D*:				
Quinton	Poor: thin layer.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope, too sandy.
Rock outcrop.				
43B Rhea	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
43C Rhea	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
43D Rhea	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
43E, 43F Rhea	Poor: slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
44B Ritzville	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
44C Ritzville	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
44D Ritzville	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
45A, 45B Ritzville	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
45C Ritzville	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
45D------------------- Ritzville	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
46E, 47E-------------- Ritzville	Poor: frost action, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
48*. Riverwash				
49F*: Rock outcrop.				
Rubble land.				
50D------------------- Rockly	Poor: area reclaim, thin layer.	Unsuited: excess fines.	Poor: excess fines.	Poor: thin layer, small stones.
51B------------------- Royal	Fair: frost action.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
51C------------------- Royal	Fair: frost action.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope, too sandy.
52B------------------- Royal	Fair: frost action.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
52C------------------- Royal	Fair: frost action.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope, too sandy.
52D------------------- Royal	Fair: frost action, slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
53A------------------- Royal	Fair: frost action.	Poor: excess fines.	Unsuited; excess fines.	Fair: too sandy.
54B------------------- Sagehill	Fair: low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
54C------------------- Sagehill	Fair: low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
54D------------------- Sagehill	Fair: low strength, frost action, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
55B------------------- Sagehill	Fair: low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
55C------------------- Sagehill	Fair: low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
56F------------------- Snell	Poor: slope, thin layer, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines, thin layer.	Poor: large stones, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
57 Snow	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
58A, 58B Taunton	Poor: thin layer.	Unsuited: thin layer.	Unsuited: excess fines.	Fair: thin layer.
58C Taunton	Poor: thin layer.	Unsuited: thin layer.	Unsuited: excess fines.	Fair: slope, thin layer.
59B Taunton	Poor: thin layer.	Unsuited: thin layer.	Unsuited: excess fines.	Fair: thin layer.
60C Tolo	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
60E, 60F Tolo	Poor: slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
61E Ukiah	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
62D Utley	Fair: low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones, slope.
63B Valby	Poor: area reclaim, frost action, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.
63C Valby	Poor: area reclaim, frost action, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer, area reclaim.
64D, 65D Valby	Poor: area reclaim, frost action, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
65E Valby	Poor: slope, area reclaim, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
66B Waha	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.
67D Waha	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
67E Waha	Poor: slope, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
68D Waha	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
69D*:				
Waha	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer, area reclaim.
Rockly	Poor: area reclaim, thin layer.	Unsuited: excess fines.	Poor: excess fines.	Poor: thin layer, small stones.
70B Warden	Fair: low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
70C Warden	Fair: low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
70D Warden	Fair: low strength, slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
71A, 71B Warden	Fair: low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
71C Warden	Fair: low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
71D Warden	Fair: low strength, slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
71E Warden	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
72C Warden	Fair: low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
72D Warden	Fair: low strength, slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
73E Waterbury	Poor: thin layer, low strength, shrink-swell.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: slope, large stones, too clayey.
74F*:				
Waterbury	Poor: thin layer, shrink-swell, slope.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: slope, large stones, too clayey.
Rock outcrop.				
75B Willis	Poor: thin layer, area reclaim.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: area reclaim, thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
75C Willis	Poor: thin layer, area reclaim.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: slope, area reclaim, thin layer.
75D Willis	Poor: thin layer, area reclaim.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: slope.
76B Winchester	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
77F*:				
Wrentham	Poor: slope, thin layer, large stones.	Unsuited: excess fines.	Poor: excess fines.	Poor: slope, small stones.
Rock outcrop.				
78*. Xeric Torriorthents				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1*:						
Aquepts.						
Aquolls.						
2D Bakeoven	Slope, depth to rock.	Thin layer			Depth to rock, slope.	Rooting depth, slope.
3D*:						
Bakeoven	Slope, depth to rock.	Thin layer			Depth to rock, slope.	Rooting depth, slope.
Morrow	Slope, depth to rock.	Piping, thin layer.	Slope, depth to rock.	Slope, rooting depth, erodes easily.	Depth to rock	Droughty, erodes easily, rooting depth.
4D*:						
Bakeoven	Slope, depth to rock.	Thin layer			Depth to rock, slope.	Rooting depth, slope.
Valby	Slope, depth to rock.	Piping, thin layer.	Slope, depth to rock.	Slope, rooting depth.	Depth to rock	Rooting depth.
5E Boardtree	Slope	Piping			Slope, percs slowly.	Slope, percs slowly.
6C Bocker	Depth to rock	Thin layer			Depth to rock	Rooting depth, droughty.
7C*:						
Bocker	Depth to rock	Thin layer			Depth to rock	Rooting depth, droughty.
Wrightman	Depth to rock, slope.	Thin layer	Depth to rock, slope.	Rooting depth, slope.	Rooting depth	Slope, rooting depth.
8B Burbank	Seepage	Seepage	Slope, cutbanks cave.	Slope, droughty, soil blowing.	Soil blowing, droughty.	Droughty.
8C Burbank	Slope, seepage.	Seepage	Slope, cutbanks cave.	Slope, droughty, soil blowing.	Slope, soil blowing, droughty.	Droughty.
9*. Dune land						
10B Ellum	Seepage	Seepage	Slope, cemented pan.	Slope, rooting depth, droughty.	Cemented pan	Rooting depth, droughty.
10C Ellum	Slope, seepage.	Seepage	Slope, cemented pan.	Slope, rooting depth, droughty.	Cemented pan	Rooting depth, droughty.
11 Endersby	Seepage	Piping, seepage.	Favorable	Droughty	Favorable	Favorable.
12 Esquatzel	Seepage	Piping	Favorable	Favorable	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
13D, 13E Gravden	Slope, cemented pan.	Seepage, thin layer.			Slope, cemented pan.	Slope, droughty, rooting depth.
14E Gwin	Slope, depth to rock.	Thin layer, large stones.			Slope, large stones, depth to rock.	Slope, large stones, rooting depth.
15F*: Gwin	Slope, depth to rock.	Thin layer, large stones.			Slope, large stones, depth to rock.	Slope, large stones, rooting depth.
Rock outcrop.						
16C Hall Ranch	Seepage, depth to rock.	Thin layer	Slope, depth to rock.	Slope, rooting depth.	Depth to rock	Rooting depth.
17E Hall Ranch	Seepage, depth to rock.	Thin layer	Slope, depth to rock.	Slope, rooting depth.	Slope, depth to rock.	Rooting depth, slope.
18E Hankins	Slope	Hard to pack	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.
19C Helter	Seepage, depth to rock.	Piping	Depth to rock, frost action, slope.	Erodes easily, slope.	Erodes easily	Erodes easily, slope.
19E, 19F Helter	Seepage, depth to rock.	Piping	Depth to rock, frost action, slope.	Erodes easily, slope.	Erodes easily, slope.	Erodes easily, slope.
20B Hezel	Favorable	Piping	Slope	Slope, soil blowing, too sandy.	Soil blowing	Favorable.
20C Hezel	Slope	Piping	Slope	Slope, soil blowing, too sandy.	Slope, soil blowing.	Slope.
21B Irrigon	Depth to rock	Piping	Slope, depth to rock.	Slope, rooting depth, droughty.	Slope, depth to rock.	Slope, rooting depth.
21C Irrigon	Slope, depth to rock.	Piping	Slope, depth to rock.	Slope, rooting depth, droughty.	Slope, depth to rock.	Slope, rooting depth.
22 Kimberly	Seepage	Seepage, piping.	Cutbanks cave	Favorable	Favorable	Favorable.
23D Klicker	Depth to rock	Thin layer, piping.	Depth to rock, slope.	Rooting depth, large stones, slope.	Large stones	Slope, large stones, rooting depth.
24E, 24F, 25E, 25F Klicker	Depth to rock	Thin layer, piping.	Depth to rock, slope.	Rooting depth, large stones, slope.	Large stones, slope.	Slope, large stones, rooting depth.
26B Koehler	Cemented pan, seepage.	Piping, seepage.	Slope, cemented pan, poor outlets.	Slope, droughty.	Cemented pan	Droughty, rooting depth.
26C Koehler	Slope, cemented pan, seepage.	Piping, seepage.	Slope, cemented pan, poor outlets.	Slope, droughty.	Slope, cemented pan.	Droughty, rooting depth.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
27E--------------- Labuck	Slope, seepage, depth to rock.	Thin layer-----	Depth to rock, slope.	Slope, rooting depth, droughty.	Slope, depth to rock.	Slope, rooting depth.
28E--------------- Lickskillet	Slope, depth to rock.	Thin layer, large stones.			Depth to rock, large stones, slope.	Rooting depth, large stones, slope.
29F*: Lickskillet------	Slope, depth to rock.	Thin layer, large stones.			Depth to rock, large stones, slope.	Rooting depth, large stones, slope.
Rock outcrop.						
30B, 30C---------- Mikkalo	Depth to rock, seepage.	Thin layer-----	Slope, depth to rock.	Slope, rooting depth, erodes easily.	Depth to rock, erodes easily.	Rooting depth.
30D--------------- Mikkalo	Depth to rock, seepage.	Thin layer-----	Slope, depth to rock.	Slope, rooting depth, erodes easily.	Slope, depth to rock.	Slope, rooting depth.
31B--------------- Morrow	Depth to rock	Piping, thin layer.	Depth to rock	Slope, rooting depth, erodes easily.	Depth to rock	Droughty, erodes easily, rooting depth.
31C--------------- Morrow	Slope, depth to rock.	Piping, thin layer.	Slope, depth to rock.	Slope, rooting depth, erodes easily.	Depth to rock	Droughty, erodes easily, rooting depth.
32D, 32E, 33D, 33E-------------- Morrow	Slope, depth to rock.	Piping, thin layer.	Slope, depth to rock.	Slope, rooting depth, erodes easily.	Slope, depth to rock.	Slope, rooting depth, erodes easily.
34F--------------- Nansene	Slope----------	Piping---------			Slope, erodes easily.	Slope, erodes easily.
35---------------- Onyx	Seepage--------	Piping---------	Floods, frost action.	Erodes easily, floods.	Favorable------	Erodes easily.
36---------------- Pedigo	Seepage--------	Piping---------	Wetness--------	Wetness--------	Wetness--------	Favorable.
37A--------------- Prosser	Depth to rock	Piping, thin layer.	Depth to rock	Rooting depth, erodes easily.	Depth to rock, erodes easily.	Erodes easily.
37B--------------- Prosser	Depth to rock	Piping, thin layer.	Slope, depth to rock.	Slope, rooting depth, erodes easily.	Depth to rock, erodes easily.	Erodes easily.
38D*: Prosser----------	Slope, depth to rock.	Piping, thin layer.	Slope, depth to rock.	Slope, rooting depth, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily.
Rock outcrop.						
39C, 40C---------- Quincy	Slope, seepage.	Piping, seepage.	Slope, cutbanks cave.	Complex slope, soil blowing, droughty.	Soil blowing, too sandy.	Droughty.
41B--------------- Quinton	Seepage--------	Piping---------	Slope, depth to rock, cutbanks cave.	Droughty, fast intake, soil blowing.	Soil blowing, too sandy.	Depth to rock, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
42D*:						
Quinton	Seepage	Piping	Slope, depth to rock, cutbanks cave.	Droughty, fast intake, soil blowing.	Soil blowing, too sandy.	Depth to rock, droughty.
Rock outcrop.						
43B Rhea	Seepage	Piping	Frost action	Slope, erodes easily.	Erodes easily	Erodes easily.
43C Rhea	Slope, seepage.	Piping	Slope, frost action.	Slope, erodes easily.	Erodes easily	Erodes easily.
43D, 43E, 43F Rhea	Slope, seepage.	Piping	Slope, frost action.	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
44B Ritzville	Seepage	Piping	Slope, frost action.	Complex slope, erodes easily.	Erodes easily	Erodes easily.
44C, 44D Ritzville	Slope, seepage.	Piping	Slope, frost action.	Complex slope, erodes easily.	Complex slope, erodes easily.	Complex slope, erodes easily.
45A, 45B Ritzville	Seepage	Piping	Slope, frost action.	Complex slope, erodes easily.	Erodes easily	Erodes easily.
45C, 45D, 46E, 47E Ritzville	Slope, seepage.	Piping	Slope, frost action.	Complex slope, erodes easily.	Complex slope, erodes easily.	Complex slope, erodes easily.
48*. Riverwash						
49F*:						
Rock outcrop.						
Rubble land.						
50D Rockly	Slope, depth to rock.	Thin layer			Large stones, depth to rock.	Large stones, rooting depth, slope.
51B Royal	Seepage	Piping, seepage.	Slope, cutbanks cave.	Slope, erodes easily.	Soil blowing	Erodes easily.
51C Royal	Slope, seepage.	Piping, seepage.	Slope, cutbanks cave.	Slope, erodes easily.	Slope, soil blowing.	Erodes easily.
52B Royal	Seepage	Piping, seepage.	Slope, cutbanks cave.	Slope, erodes easily.	Soil blowing	Erodes easily.
52C, 52D Royal	Slope, seepage.	Piping, seepage.	Slope, cutbanks cave.	Slope, erodes easily.	Slope, soil blowing.	Slope, erodes easily.
53A Royal	Seepage	Piping, seepage.	Cutbanks cave	Droughty, erodes easily.	Soil blowing	Erodes easily.
54B Sagehill	Slope, seepage.	Piping	Slope	Slope, erodes easily, soil blowing.	Erodes easily, soil blowing.	Erodes easily.
54C, 54D Sagehill	Slope, seepage.	Piping	Slope	Slope, erodes easily, soil blowing.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
55B Sagehill	Slope, seepage.	Piping	Slope	Slope, erodes easily, soil blowing.	Erodes easily, soil blowing.	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
55C Sagehill	Slope, seepage.	Piping	Slope	Slope, erodes easily, soil blowing.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
56F Snell	Slope, depth to rock.	Large stones, thin layer.			Depth to rock, large stones.	Rooting depth, large stones.
57 Snow	Seepage	Piping	Favorable	Favorable	Favorable	Favorable.
58A Taunton	Cemented pan, seepage.	Thin layer, piping.	Cemented pan	Rooting depth, droughty.	Cemented pan, rooting depth.	Rooting depth.
58B Taunton	Cemented pan, seepage.	Thin layer, piping.	Slope, cemented pan.	Slope, rooting depth, erodes easily.	Cemented pan, rooting depth.	Rooting depth, erodes easily.
58C Taunton	Slope, cemented pan, seepage.	Thin layer, piping.	Slope, cemented pan.	Slope, rooting depth, erodes easily.	Slope, cemented pan, erodes easily.	Slope, rooting depth, erodes easily.
59B Taunton	Cemented pan, seepage.	Thin layer, piping.	Slope, cemented pan.	Slope, rooting depth, erodes easily.	Cemented pan, rooting depth.	Rooting depth, erodes easily.
60C, 60E, 60F Tolo	Slope, seepage.	Piping	Slope, frost action.	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
61E Ukiah	Slope, depth to rock.	Thin layer	Slope, percs slowly, large stones.	Slope, percs slowly, slow intake.	Slope, percs slowly, large stones.	Slope, percs slowly, large stones.
62D Utley	Seepage, slope.	Piping	Slope	Slope	Slope	Slope.
63B Valby	Depth to rock	Piping, thin layer.	Slope, depth to rock.	Slope, rooting depth.	Depth to rock	Rooting depth.
63C Valby	Slope, depth to rock.	Piping, thin layer.	Slope, depth to rock.	Slope, rooting depth.	Depth to rock	Rooting depth.
64D, 65D, 65E Valby	Slope, depth to rock.	Piping, thin layer.	Slope, depth to rock.	Slope, rooting depth.	Slope, depth to rock.	Slope, rooting depth.
66B Waha	Depth to rock	Thin layer	Slope, depth to rock.	Slope, rooting depth.	Depth to rock	Rooting depth.
67D, 67E, 68D Waha	Slope, depth to rock.	Thin layer	Slope, depth to rock.	Slope, rooting depth.	Slope, depth to rock.	Slope, rooting depth.
69D*:						
Waha	Slope, depth to rock.	Thin layer	Slope, depth to rock.	Slope, rooting depth.	Slope, depth to rock.	Slope, rooting depth.
Rockly	Slope, depth to rock.	Thin layer			Large stones, depth to rock.	Large stones, rooting depth, slope.
70B Warden	Favorable	Piping	Slope	Slope, erodes easily.	Erodes easily	Erodes easily.
70C, 70D Warden	Slope	Slope, piping.	Slope	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
71A Warden	Favorable	Piping	Favorable	Favorable	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
71B--------------- Warden	Favorable------	Piping---------	Slope----------	Slope, erodes easily.	Erodes easily	Erodes easily.
71C, 71D, 71E----- Warden	Slope----------	Slope, piping.	Slope----------	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
72C--------------- Warden	Favorable------	Piping---------	Slope----------	Slope, erodes easily.	Erodes easily	Erodes easily.
72D--------------- Warden	Slope----------	Slope, piping.	Slope----------	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
73E--------------- Waterbury	Depth to rock, slope.	Thin layer-----			Depth to rock, large stones, slope.	Large stones, rooting depth, slope.
74F*:						
Waterbury--------	Depth to rock, slope.	Thin layer-----			Depth to rock, large stones, slope.	Large stones, rooting depth, slope.
Rock outcrop.						
75B--------------- Willis	Cemented pan---	Thin layer, piping.	Slope, cemented pan.	Slope, rooting depth, erodes easily.	Cemented pan---	Rooting depth, erodes easily.
75C, 75D---------- Willis	Slope, cemented pan.	Thin layer, piping.	Slope, cemented pan.	Slope, rooting depth, erodes easily.	Slope, cemented pan, erodes easily.	Slope, rooting depth, erodes easily.
76B--------------- Winchester	Slope, seepage.	Piping, seepage.	Slope, cutbanks cave.	Complex slope, soil blowing, droughty.	Soil blowing, too sandy.	Droughty.
77F*:						
Wrentham---------	Slope----------	Large stones, piping.			Slope, large stones, depth to rock.	Slope, large stones.
Rock outcrop.						
78*. Xeric Torriorthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1*:				
Aquepts.				
Aquolls.				
2D Bakeoven	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: slope, depth to rock, large stones.	Severe: large stones.
3D*:				
Bakeoven	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: slope, depth to rock, large stones.	Severe: large stones.
Morrow	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
4D*:				
Bakeoven	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: slope, depth to rock, large stones.	Severe: large stones.
Valby	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
5E Boardtree	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Moderate: slope.
6C Bocker	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: depth to rock, small stones, slope.	Severe: small stones.
7C*:				
Bocker	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: depth to rock, small stones, slope.	Severe: small stones.
Wrightman	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
8B Burbank	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy, small stones.	Moderate: too sandy.
8C Burbank	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
9*. Dune land				
10B Ellum	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
10C Ellum	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
11 Endersby	Severe: floods.	Slight	Slight	Slight.
12 Esquatzel	Severe: floods.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
13D Gravden	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: slope, small stones, cemented pan.	Severe: small stones.
13E Gravden	Severe: slope, small stones, cemented pan.	Severe: slope, small stones, cemented pan.	Severe: slope, small stones, cemented pan.	Severe: slope, small stones.
14E Gwin	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: depth to rock, slope, large stones.	Severe: slope, large stones.
15F*:				
Gwin	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: depth to rock, slope, large stones.	Severe: slope, large stones.
Rock outcrop.				
16C Hall Ranch	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
17E Hall Ranch	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones, dusty.
18E Hankins	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
19C Helter	Moderate: slope, percs slowly, dusty.	Moderate: slope, percs slowly, dusty.	Severe: slope.	Moderate: dusty.
19E, 19F Helter	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
20B Hezel	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
20C Hezel	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
21B Irrigon	Slight	Slight	Moderate: slope, depth to rock.	Slight.
21C Irrigon	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
22 Kimberly	Severe: floods.	Slight	Slight	Slight.
23D Klicker	Severe: large stones.	Moderate: slope, large stones.	Severe: slope, large stones.	Severe: large stones.
24E, 24F, 25E, 25F Klicker	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.	Severe: large stones, slope.
26B Koehler	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
26C Koehler	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
27E Labuck	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
28E Lickskillet	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: large stones, depth to rock.
29F*:				
Lickskillet	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.
Rock outcrop.				
30B Mikkalo	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock, dusty.	Moderate: dusty.
30C Mikkalo	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
30D Mikkalo	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
31B Morrow	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
31C Morrow	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
32D Morrow	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
32E Morrow	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
33D Morrow	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
33E Morrow	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
34F Nansene	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
35 Onyx	Severe: floods.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
36 Pedigo	Severe: floods.	Moderate: wetness, dusty.	Moderate: wetness, dusty.	Moderate: wetness, dusty.
37A Prosser	Moderate: dusty.	Moderate: dusty.	Moderate: dusty, depth to rock.	Moderate: dusty.
37B Prosser	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty, depth to rock.	Moderate: dusty.
38D*:				
Prosser	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Rock outcrop.				
39C, 40C Quincy	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Moderate: too sandy.
41B Quinton	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, depth to rock, slope.	Moderate: too sandy.
42D*:				
Quinton	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Rock outcrop.				
43B Rhea	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
43C Rhea	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
43D Rhea	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
43E, 43F Rhea	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
44B Ritzville	Moderate: dusty.	Moderate: dusty.	Moderate: dusty, slope.	Moderate: dusty.
44C Ritzville	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
44D Ritzville	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
45A, 45B Ritzville	Moderate: dusty.	Moderate: dusty.	Moderate: dusty, slope.	Moderate: dusty.
45C Ritzville	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
45D Ritzville	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
46E, 47E Ritzville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
48*. Riverwash				
49F*: Rock outcrop.				
Rubble land.				
50D Rockly	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: small stones.
51B Royal	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
51C Royal	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
52B Royal	Slight	Slight	Moderate: slope.	Slight.
52C Royal	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
52D Royal	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
53A Royal	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
54B Sagehill	Slight	Slight	Moderate: slope.	Slight.
54C Sagehill	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
54D Sagehill	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
55B Sagehill	Slight	Slight	Moderate: slope.	Slight.
55C Sagehill	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
56F Snell	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
57 Snow	Severe: floods.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
58A Taunton	Slight	Slight	Slight	Slight.
58B Taunton	Slight	Slight	Moderate: slope, cemented pan.	Slight.
58C Taunton	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
59B Taunton	Slight	Slight	Moderate: slope, cemented pan.	Slight.
60C Tolo	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
60E, 60F Tolo	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
61E Ukiah	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.	Moderate: slope, large stones.
62D Utley	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
63B Valby	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock, dusty.	Moderate: dusty.
63C Valby	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
64D, 65D Valby	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
65E Valby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
66B Waha	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock, dusty.	Moderate: dusty.
67D Waha	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
67E Waha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
68D Waha	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
69D*:				
Waha	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Rockly	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: small stones.
70B Warden	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
70C Warden	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
70D Warden	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
71A Warden	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
71B Warden	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
71C Warden	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
71D Warden	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
71E Warden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
72C Warden	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
72D Warden	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
73E Waterbury	Severe: large stones, depth to rock, slope.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones.
74F*:				
Waterbury	Severe: large stones, depth to rock, slope.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones, slope.
Rock outcrop.				
75B Willis	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty, cemented pan.	Moderate: dusty.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
75C------------------- Willis	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
75D------------------- Willis	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: slope, dusty.
76B------------------- Winchester	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Moderate: too sandy.
77F*:				
Wrentham-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.				
78*. Xeric Torriorthents				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1*:											
Aquepts.											
Aquolls.											
2D----------------- Bakeoven	Very poor.	Very poor.	Fair	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
3D*:											
Bakeoven-----------	Very poor.	Very poor.	Fair	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
Morrow-------------	Poor	Fair	Good	---	Very poor.	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
4D*:											
Bakeoven-----------	Very poor.	Very poor.	Fair	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
Valby--------------	Fair	Good	Good	---	Very poor.	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
5E----------------- Boardtree	Very poor.	Very poor.	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	---
6C----------------- Bocker	Very poor.	Very poor.	Poor	---	Very poor.	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
7C*:											
Bocker-------------	Very poor.	Very poor.	Poor	---	Very poor.	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
Wrightman----------	Poor	Poor	Good	Very poor.	Good	Very poor.	Very poor.	Poor	---	Very poor.	Good.
8B, 8C------------- Burbank	Very poor.	Very poor.	Poor	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
9*. Dune land											
10B, 10C----------- Ellum	Very poor.	Very poor.	Poor	---	Very poor.	Very poor.	Very poor.	Very poor.	---	Very poor.	Very poor.
11----------------- Endersby	Good	Good	Good	---	Fair	Very poor.	Very poor.	Good	---	Very poor.	Fair.
12----------------- Esquatzel	Fair	Fair	Good	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Good.
13D, 13E----------- Gravden	Very poor.	Very poor.	Fair	---	Very poor.	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
14E---------------- Gwin	Very poor.	Very poor.	Fair	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
15F*:											
Gwin---------------	Very poor.	Very poor.	Fair	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
Rock outcrop.											

See footnote at end of table.

TABLE 15.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
16C, 17E Hall Ranch	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	---
18E Hankins	Poor	Fair	Fair	Good	Poor	Very poor.	Very poor.	---	Good	Very poor.	Poor.
19C, 19E, 19F Helter	Very poor.	Very poor.	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Good	Very poor.	---
20B, 20C Hezel	Very poor.	Very poor.	Fair	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Very poor.
21B, 21C Irrigon	Poor	Poor	Fair	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
22 Kimberly	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Fair	Poor	---
23D, 24E, 24F, 25E, 25F Klicker	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	---
26B, 26C Koehler	Very poor.	Very poor.	Poor	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
27E Labuck	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	---
28E Lickskillet	Very poor.	Very poor.	Fair	---	Very poor.	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
29F*: Lickskillet	Very poor.	Very poor.	Fair	---	Very poor.	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
Rock outcrop.											
30B, 30C, 30D Mikkalo	Fair	Good	Fair	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
31B, 31C, 32D, 32E, 33D, 33E Morrow	Poor	Fair	Good	---	Very poor.	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
34F Nansene	Very poor.	Very poor.	Good	---	Very poor.	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
35 Onyx	Good	Good	Good	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
36 Pedigo	Good	Good	Fair	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
37A, 37B Prosser	Poor	Poor	Good	---	Good	Very poor.	Very poor.	Poor	---	Very poor.	Good.
38D*: Prosser	Poor	Poor	Good	---	Good	Very poor.	Very poor.	Poor	---	Very poor.	Good.
Rock outcrop.											
39C, 40C Quincy	Very poor.	Very poor.	Poor	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.

See footnote at end of table.

TABLE 15.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
41B---------------- Quinton	Very poor.	Very poor.	Poor	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
42D*:											
Quinton-----------	Very poor.	Very poor.	Poor	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
Rock outcrop.											
43B---------------- Rhea	Fair	Good	Good	---	Very poor.	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
43C, 43D, 43E------ Rhea	Poor	Fair	Good	---	Very poor.	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
43F---------------- Rhea	Very poor.	Fair	Good	---	Very poor.	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
44B, 44C, 44D, 45A, 45B, 45C, 45D----- Ritzville	Fair	Fair	Good	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
46E, 47E----------- Ritzville	Fair	Fair	Good	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
48*. Riverwash											
49F*: Rock outcrop.											
Rubble land.											
50D---------------- Rockly	Very poor.	Very poor.	Fair	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
51B, 51C, 52B, 52C, 52D, 53A---------- Royal	Very poor.	Very poor.	Poor	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
54B, 54C, 54D, 55B, 55C--------------- Sagehill	Very poor.	Very poor.	Good	---	Good	Very poor.	Very poor.	Poor	---	Very poor.	Good.
56F---------------- Snell	Very poor.	Poor	Fair	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
57----------------- Snow	Good	Good	Good	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
58A, 58B, 58C, 59B- Taunton	Poor	Poor	Fair	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
60C, 60E----------- Tolo	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
60F---------------- Tolo	Very poor.	Poor	Poor	Good	Fair	Very poor.	Very poor.	Very poor.	Good	Very poor.	---
61E---------------- Ukiah	Poor	Fair	Fair	Poor	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
62D---------------- Utley	Poor	Good	Good	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.

See footnote at end of table.

TABLE 15.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
63B, 63C Valby	Fair	Good	Good	---	Very poor.	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
64D, 65D, 65E. Valby											
66B, 67D Waha	Fair	Good	Good	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
67E Waha	Poor	Fair	Good	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
68D Waha	Fair	Good	Good	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
69D*: Waha	Fair	Good	Good	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Rockly	Very poor.	Very poor.	Fair	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
70B, 70C, 70D, 71A, 71B, 71C, 71D Warden	Poor	Fair	Fair	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
71E Warden	Poor	Poor	Fair	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
72C, 72D Warden	Poor	Fair	Fair	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
73E Waterbury	Very poor.	Very poor.	Fair	Very poor.	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
74F*: Waterbury	Very poor.	Very poor.	Fair	Very poor.	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
Rock outcrop.											
75B, 75C Willis	Fair	Fair	Fair	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
75D. Willis											
76B Winchester	Very poor.	Very poor.	Fair	---	Poor	Poor	Very poor.	Very poor.	---	Very poor.	Poor.
77F*: Wrentham	Very poor.	Very poor.	Good	---	Very poor.	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
Rock outcrop.											
78*. Xeric Torriorthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1*:											
Aquepts.											
Aquolls.											
2D------------------ Bakeoven	0-2	Very cobbly loam	GM-GC, GM, SM-SC, SM	A-4	25-55	65-80	60-75	50-70	35-50	25-35	5-10
	2-7	Very gravelly clay loam, very cobbly loam, very gravelly loam.	GM	A-6	15-55	50-65	45-60	40-55	35-50	35-40	10-15
	7	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
3D*:											
Bakeoven----------	0-2	Very cobbly loam	GM-GC, GM, SM-SC, SM	A-4	25-55	65-80	60-75	50-70	35-50	25-35	5-10
	2-7	Very gravelly clay loam, very cobbly loam, very gravelly loam.	GM	A-6	15-55	50-65	45-60	40-55	35-50	35-40	10-15
	7	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Morrow------------	0-9	Silt loam-------	ML	A-4	0	95-100	95-100	90-100	80-90	30-35	5-10
	9-14	Silty clay loam	CL	A-6	0	95-100	95-100	90-100	80-95	35-40	15-20
	14-26	Silt loam, silty clay loam.	ML	A-4	0	95-100	95-100	90-100	80-90	30-35	5-10
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
4D*:											
Bakeoven----------	0-2	Very cobbly loam	GM-GC, GM, SM-SC, SM	A-4	25-55	65-80	60-75	50-70	35-50	25-35	5-10
	2-7	Very gravelly clay loam, very cobbly loam, very gravelly loam.	GM	A-6	15-55	50-65	45-60	40-55	35-50	35-40	10-15
	7	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Valby-------------	0-8	Silt loam-------	ML, CL-ML	A-4	0	95-100	95-100	85-100	80-90	25-35	5-10
	8-30	Silt loam-------	ML, CL-ML	A-4	0	95-100	95-100	85-100	80-90	25-35	5-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
5E------------------ Boardtree	0-14	Loam------------	ML	A-4	0	90-100	85-100	75-95	60-75	30-40	NP-5
	14-25	Loam, silt loam	ML	A-4	0	90-100	85-100	75-95	60-80	30-40	NP-5
	25-60	Clay, silty clay, clay loam.	CH	A-7	0	80-90	75-90	70-85	50-85	50-65	30-40

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
6C----------------- Bocker	0-2	Very cobbly silt loam.	GM	A-4	25-40	55-65	45-55	40-50	35-45	20-30	NP-5
	2-8	Very gravelly loam, very cobbly silt loam.	GM	A-2	0-40	50-60	40-50	35-45	25-35	20-30	NP-5
	8	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
7C*:											
Bocker------------	0-2	Very cobbly silt loam.	GM	A-4	25-40	55-65	45-55	40-50	35-45	20-30	NP-5
	2-8	Very gravelly loam, very cobbly silt loam.	GM	A-2	0-40	50-60	40-50	35-45	25-35	20-30	NP-5
	8	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wrightman---------	0-12	Silt loam-------	ML, CL-ML	A-4	0-10	95-100	90-100	75-95	55-85	25-35	5-10
	12-26	Loam, silt loam, clay loam.	ML, CL-ML	A-4	0-10	95-100	75-90	70-85	50-75	25-35	5-10
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
8B, 8C------------- Burbank	0-5	Loamy fine sand	SM	A-2	0-5	95-100	80-95	60-80	15-35	---	NP
	5-20	Loamy sand, loamy fine sand, gravelly loamy sand.	SM	A-2	0-5	85-95	70-90	60-80	15-35	---	NP
	20-34	Very gravelly loamy sand, very gravelly loamy fine sand, very cobbly loamy fine sand.	SM, SP-SM, GM, GP-GM	A-1	5-40	50-75	20-45	15-35	5-15	---	NP
	34-60	Very gravelly sand, very cobbly coarse sand.	GP	A-1	15-50	35-45	10-40	5-15	0-5	---	NP
9*. Dune land											
10B, 10C----------- Ellum	0-13	Fine sandy loam	SM, ML	A-4	0	95-100	95-100	65-85	40-55	---	NP
	13-28	Very gravelly fine sandy loam.	GM	A-1	5-15	35-40	25-35	20-30	10-20	---	NP
	28	Cemented--------	---	---	---	---	---	---	---	---	---
11----------------- Endersby	0-12	Fine sandy loam	SM	A-4	0	75-100	75-100	50-65	35-50	20-25	NP-5
	12-36	Fine sandy loam, loam.	SM, ML	A-4	0	75-100	75-100	50-85	35-55	20-25	NP-5
	36-60	Stratified silt loam to loamy sand.	SM, ML	A-2, A-4	0	90-100	80-100	30-60	25-55	20-25	NP-5
12----------------- Esquatzel	0-17	Silt loam-------	ML	A-4	0	100	100	90-100	75-95	20-30	NP-5
	17-60	Silt loam-------	ML	A-4	0	100	100	95-100	75-85	20-30	NP-5
13D, 13E----------- Gravden	0-7	Very gravelly loam.	GM	A-1, A-2	0-20	40-55	35-50	20-40	20-35	---	NP
	7-14	Very gravelly loam.	GM	A-1	10-30	30-50	20-40	15-35	10-20	---	NP
	14	Cemented--------	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
14E---------------- Gwin	0-3	Extremely stony silt loam.	GM	A-2, A-4	45-70	45-60	35-55	35-55	30-50	25-30	NP-5
	3-15	Very cobbly silty clay loam, very cobbly clay loam, very cobbly silt loam.	GM	A-2, A-4	50-70	45-60	35-55	35-55	30-50	30-40	5-15
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
15F*:											
Gwin--------------	0-3	Extremely stony silt loam.	GM	A-2, A-4	45-70	45-60	35-55	35-55	30-50	25-30	NP-5
	3-15	Very cobbly silty clay loam, very cobbly clay loam, very cobbly silt loam.	GM	A-2, A-4	50-70	45-60	35-55	35-55	30-50	30-40	5-15
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
16C---------------- Hall Ranch	0-7	Loam------------	ML	A-4	0	80-95	75-90	65-85	50-75	30-40	5-10
	7-23	Loam, gravelly loam, gravelly silt loam.	ML	A-4	0-5	70-95	55-90	55-85	50-75	30-40	5-10
	23	Weathered bedrock.	---	---	---	---	---	---	---	---	---
17E---------------- Hall Ranch	0-7	Gravelly loam---	ML	A-4	0	70-90	55-80	55-70	50-60	30-40	5-10
	7-23	Loam, gravelly loam, gravelly silt loam.	ML	A-4	0-5	70-95	55-90	55-85	50-75	30-40	5-10
	23	Weathered bedrock.	---	---	---	---	---	---	---	---	---
18E---------------- Hankins	0-12	Silt loam-------	ML	A-6, A-4	0-5	90-100	85-100	85-100	70-95	30-40	5-15
	12-60	Clay, clay loam, silty clay loam.	CH	A-7	0-15	90-100	85-100	85-100	65-95	50-65	25-35
19C, 19E, 19F------ Helter	0-26	Silt loam-------	ML	A-4, A-5	0	100	100	95-100	85-95	35-45	NP-5
	26-37	Silt loam, loam, silty clay loam.	ML	A-4	0	95-100	90-100	75-100	60-95	30-40	5-10
	37-55	Very gravelly loam, gravelly silt loam.	ML, GM, SM	A-4	0-25	50-80	45-75	40-70	35-65	25-30	NP-5
	55	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
20B, 20C----------- Hezel	0-9	Loamy fine sand	SM	A-2	0	100	100	50-85	15-35	---	NP
	9-30	Loamy fine sand, loamy sand, loamy very fine sand.	SM	A-2	0	100	100	50-75	15-35	---	NP
	30-60	Stratified silt loam to fine sandy loam.	ML	A-4	0	100	100	80-100	50-90	20-25	NP-5

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
21B, 21C-----------	0-3	Fine sandy loam	SM, ML	A-4	0	95-100	95-100	65-85	40-55	---	NP
Irrigon	3-23	Loam, fine sandy loam.	ML	A-4	0	95-100	95-100	80-95	55-75	---	NP
	23	Weathered bedrock.	---	---	---	---	---	---	---	---	---
22-----------------	0-15	Fine sandy loam	ML, SM	A-4, A-2	0	100	100	60-90	30-70	---	NP
Kimberly	15-60	Sandy loam, fine sandy loam.	SM	A-4, A-2	0	100	100	60-80	30-50	---	NP
23D----------------	0-11	Stony silt loam	ML	A-4	10-20	80-95	70-90	55-85	55-80	30-40	5-10
Klicker	11-26	Very cobbly silt loam, very cobbly silty clay loam.	ML, SM, GM	A-7	40-50	70-80	65-75	60-70	40-65	40-50	10-20
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
24E, 24F-----------	0-11	Stony silt loam	ML	A-4	10-20	80-95	70-90	55-85	55-80	30-40	5-10
Klicker	11-26	Very cobbly silt loam, very cobbly silty clay loam.	ML, SM, GM	A-7	40-50	70-80	65-75	60-70	40-65	40-50	10-20
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
25E, 25F----------- Klicker	0-11	Very stony silt loam.	ML	A-4	15-25	75-90	65-85	50-80	50-75	30-40	5-10
	11-26	Very cobbly silt loam, very cobbly silty clay loam.	ML, SM, GM	A-7	40-50	70-80	65-75	60-70	40-65	40-50	10-20
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
26B, 26C-----------	0-4	Loamy fine sand	SM	A-2	0-5	85-95	80-90	70-80	15-30	---	NP
Koehler	4-28	Loamy fine sand, loamy sand, fine sand.	SM	A-2	0-5	80-90	80-90	65-80	15-25	---	NP
	28	Indurated-------	---	---	---	---	---	---	---	---	---
27E----------------	0-14	Loam------------	ML	A-4	0	100	75-90	65-80	50-70	---	NP
Labuck	14-31	Gravelly loam, gravelly sandy loam.	SM	A-4	0	100	50-75	40-70	35-50	---	NP
	31	Weathered bedrock.	---	---	---	---	---	---	---	---	---
28E---------------- Lickskillet	0-2	Very stony loam	GM-GC, CL-ML	A-4	20-50	60-90	60-85	50-80	35-65	25-30	5-10
	2-17	Very cobbly clay loam, very gravelly loam, very cobbly loam.	GC	A-2, A-6, A-7	15-50	40-65	25-50	20-50	15-40	35-45	15-20
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
29F*:											
Lickskillet	0-2	Extremely stony loam.	GM-GC, CL-ML	A-4	20-50	60-90	60-85	50-80	35-65	25-30	5-10
	2-17	Very cobbly clay loam, very gravelly loam, very cobbly loam.	GC	A-2, A-6, A-7	15-50	40-65	25-50	20-50	15-40	35-45	15-20
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
30B, 30C, 30D Mikkalo	0-13	Silt loam	ML	A-4	0	100	95-100	95-100	80-95	20-30	NP-5
	13-35	Silt loam	ML	A-4	0	100	95-100	95-100	80-90	20-30	NP-5
	35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
31B, 31C, 32D, 32E, 33D, 33E Morrow	0-9	Silt loam	ML	A-4	0	95-100	95-100	90-100	80-90	30-35	5-10
	9-14	Silty clay loam	CL	A-6	0	95-100	95-100	90-100	80-95	35-40	15-20
	14-26	Silt loam, silty clay loam.	ML	A-4	0	95-100	95-100	90-100	80-90	30-35	5-10
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
34F Nansene	0-25	Silt loam	ML	A-4	0	95-100	95-100	90-100	85-90	20-25	NP-5
	25-45	Silt loam	ML	A-4	0	95-100	95-100	90-100	85-90	20-25	NP-5
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
35 Onyx	0-26	Silt loam	ML	A-4	0	100	100	90-100	75-100	20-30	NP-5
	26-39	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	90-100	75-100	20-30	NP-5
	39-60	Gravelly silt loam, gravelly very fine sandy loam.	SM, GM	A-2, A-4	0-5	60-80	50-75	40-65	30-50	20-30	NP-5
36 Pedigo	0-10	Silt loam	ML	A-4	0	100	100	95-100	80-95	20-40	NP-10
	10-66	Silt loam	ML	A-4	0	100	100	95-100	80-95	20-40	NP-10
37A, 37B Prosser	0-4	Silt loam	ML	A-4	0	100	95-100	85-95	50-90	20-30	NP-5
	4-29	Very fine sandy loam, silt loam.	ML	A-4	0-5	95-100	90-100	80-90	50-85	20-30	NP-5
	29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
38D*:											
Prosser	0-4	Silt loam	ML	A-4	0	100	95-100	85-95	50-90	20-30	NP-5
	4-29	Very fine sandy loam, silt loam.	ML	A-4	0-5	95-100	90-100	80-90	50-85	20-30	NP-5
	29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
39C Quincy	0-6	Fine sand	SM	A-2	0	100	100	90-100	15-30	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	100	90-100	15-30	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
40C---------------- Quincy	0-6	Loamy fine sand	SM	A-2	0	100	100	90-100	15-30	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	100	90-100	15-30	---	NP
41B---------------- Quinton	0-30	Loamy fine sand	SM	A-2	0	95-100	95-100	50-80	20-35	---	NP
	30-37	Gravelly loamy fine sand, sand.	SM	A-1, A-2	0	75-100	65-100	40-80	15-30	---	NP
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
42D*: Quinton-----------	0-30	Loamy fine sand	SM	A-2	0	95-100	95-100	50-80	20-35	---	NP
	30-37	Gravelly loamy fine sand, sand.	SM	A-1, A-2	0	75-100	65-100	40-80	15-30	---	NP
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
42D*: Rock outcrop.											
43B, 43C, 43D, 43E, 43F---------------- Rhea	0-14	Silt loam-------	ML	A-4	0	100	90-100	80-100	75-90	25-30	NP-5
	14-60	Silt loam-------	ML, CL-ML	A-4	0	95-100	90-100	80-100	80-90	25-35	5-10
44B, 44C, 44D------ Ritzville	0-13	Very fine sandy loam.	ML	A-4	0	100	95-100	95-100	75-100	20-30	NP-5
	13-33	Silt loam-------	ML, CL-ML	A-4	0	100	100	95-100	80-100	20-30	NP-10
	33-70	Silt loam-------	ML	A-4	0	100	100	95-100	80-100	20-30	NP-5
45A, 45B, 45C, 45D, 46E, 47E---------- Ritzville	0-13	Silt loam-------	ML	A-4	0	100	95-100	95-100	75-100	20-30	NP-5
	13-33	Silt loam-------	ML, CL-ML	A-4	0	100	100	95-100	80-100	20-30	NP-10
	33-70	Silt loam-------	ML	A-4	0	100	100	95-100	80-100	20-30	NP-5
48*. Riverwash											
49F*: Rock outcrop.											
Rubble land.											
50D---------------- Rockly	0-6	Very gravelly loam.	GM	A-4, A-2	5-20	50-60	45-55	35-50	25-40	25-30	NP-5
	6-9	Very cobbly clay loam, very gravelly loam.	GM, GC	A-2, A-6	5-60	20-60	25-55	25-50	20-40	35-40	10-15
	9	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
51B, 51C----------- Royal	0-6	Loamy fine sand	SM	A-2, A-4	0-5	95-100	95-100	80-90	30-40	---	NP
	6-14	Fine sandy loam	SM	A-4	0-5	95-100	95-100	80-95	35-50	20-30	NP-5
	14-60	Stratified fine sandy loam to fine sand.	SM	A-2, A-4	0-5	95-100	95-100	80-95	30-45	20-30	NP-5
52B, 52C, 52D------ Royal	0-6	Fine sandy loam	SM	A-4	0-5	95-100	95-100	80-95	35-50	20-30	NP-5
	6-17	Fine sandy loam	SM	A-4	0-5	95-100	95-100	80-95	35-50	20-30	NP-5
	17-60	Stratified fine sandy loam to fine sand.	SM	A-2, A-4	0-5	95-100	95-100	80-95	30-45	20-30	NP-5

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
53A----------------	0-6	Silt loam-------	ML	A-4	0-5	95-100	95-100	85-95	60-70	25-30	NP-5
Royal	6-33	Fine sandy loam	SM	A-4	0-5	95-100	95-100	80-95	35-50	20-30	NP-5
	33-60	Stratified fine sandy loam to fine sand.	SM	A-2, A-4	0-5	95-100	95-100	80-95	30-45	20-30	NP-5
54B, 54C, 54D, 55B, 55C---------------	0-5	Fine sandy loam	ML, SM	A-4	0-5	95-100	95-100	80-95	45-60	15-25	NP-5
Sagehill	5-28	Very fine sandy loam, fine sandy loam, loamy very fine sand.	ML, SM	A-4	0-5	95-100	95-100	80-95	45-60	15-25	NP-5
	28-60	Stratified silt loam to fine sandy loam.	ML	A-4	0-5	95-100	95-100	80-95	50-90	15-25	NP-5
56F----------------	0-14	Very stony loam	ML, SM	A-5	15-30	75-90	70-85	60-80	40-60	40-50	5-10
Snell	14-30	Very stony clay loam, very stony clay, very cobbly silty clay loam.	SM, SC, GC, GM	A-7	15-30	65-80	50-60	40-50	35-50	65-75	30-45
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
57-----------------	0-33	Silt loam-------	ML	A-4	0	100	100	95-100	80-90	20-40	NP-10
Snow	33-46	Silt loam-------	ML	A-4	0	100	100	95-100	80-90	20-40	NP-10
	46-60	Silt loam, loam	ML	A-4	0	100	100	90-95	75-85	20-40	NP-10
58A, 58B, 58C, 59B-	0-5	Fine sandy loam	SM	A-4	0	95-100	90-100	80-90	40-50	15-25	NP-5
Taunton	5-32	Fine sandy loam, very fine sandy loam.	SM, ML	A-4	0	95-100	90-100	80-95	40-60	15-25	NP-5
	32	Indurated-------	---	---	---	---	---	---	---	---	---
60C, 60E, 60F------	0-25	Silt loam-------	ML	A-4, A-5	0	100	100	95-100	85-90	35-45	NP
Tolo	25-41	Silt loam, silty clay loam, loam.	ML	A-6	0	95-100	90-100	85-100	75-90	35-40	10-15
	41-60	Cobbly clay loam	CL	A-6	20-45	80-90	80-90	60-80	50-70	25-30	10-15
61E----------------	0-3	Stony silty clay loam.	ML	A-7	25-40	80-100	75-100	70-100	65-95	40-50	10-15
Ukiah	3-26	Cobbly clay, cobbly silty clay.	CH	A-7	15-40	80-100	70-85	60-80	50-70	50-60	25-35
	26	Weathered bedrock.	---	---	---	---	---	---	---	---	---
62D----------------	0-16	Loam------------	ML	A-4	0	90-100	85-95	70-90	50-70	25-35	NP-10
Utley	16-38	Loam, shaly loam, silt loam.	ML, SM	A-4	0	80-95	65-90	55-85	40-70	25-35	NP-10
	38-60	Very shaly loam, very shaly sandy loam.	SM	A-4, A-1, A-2	0	40-60	35-50	25-50	20-40	25-35	NP-10
63B, 63C, 64D, 65D, 65E---------------	0-8	Silt loam-------	ML, CL-ML	A-4	0	95-100	95-100	85-100	80-90	25-35	5-10
Valby	8-30	Silt loam-------	ML, CL-ML	A-4	0	95-100	95-100	85-100	80-90	25-35	5-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
66B, 67D, 67E, 68D- Waha	0-12	Silt loam-------	ML, CL-ML	A-4	0	100	100	95-100	90-95	20-30	NP-10
	12-27	Silty clay loam, silt loam.	CL	A-6	0	100	95-100	95-100	85-95	30-40	10-20
	27-29	Very gravelly clay loam, very cobbly silt loam.	GC	A-2	30-40	25-35	15-35	15-30	15-25	30-40	10-20
	29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
69D*:											
Waha--------------	0-12	Silt loam-------	ML, CL-ML	A-4	0	100	100	95-100	90-95	20-30	NP-10
	12-27	Silty clay loam, silt loam.	CL	A-6	0	100	95-100	95-100	85-95	30-40	10-20
	27-29	Very gravelly clay loam, very cobbly silt loam.	GC	A-2	30-40	25-35	15-35	15-30	15-25	30-40	10-20
	29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rockly------------	0-2	Very gravelly loam.	GM	A-4, A-2	5-20	50-60	40-55	35-50	25-40	25-30	NP-5
	2-9	Very cobbly clay loam, very gravelly loam.	GM, GC	A-2, A-6	5-60	20-60	25-55	25-50	20-40	35-40	10-15
	9	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
70B, 70C, 70D------ Warden	0-5	Very fine sandy loam.	ML	A-4	0	95-100	95-100	85-100	70-90	25-30	NP-5
	5-20	Very fine sandy loam, silt loam.	ML	A-4	0	95-100	95-100	85-100	70-90	25-30	NP-5
	20-60	Silt loam, very fine sandy loam.	ML	A-4	0	95-100	95-100	85-100	70-90	25-30	NP-5
71A, 71B, 71C, 71D, 71E--------------- Warden	0-5	Silt loam-------	ML	A-4	0	95-100	95-100	85-100	70-90	25-30	NP-5
	5-25	Very fine sandy loam, silt loam.	ML	A-4	0	95-100	95-100	85-100	70-90	25-30	NP-5
	25-60	Silt loam, very fine sandy loam.	ML	A-4	0	95-100	95-100	85-100	70-90	25-30	NP-5
72C, 72D----------- Warden	0-1	Silt loam-------	ML	A-4	0	95-100	95-100	85-100	70-90	25-30	NP-5
	1-21	Very fine sandy loam, silt loam.	ML	A-4	0	95-100	95-100	85-100	70-90	25-30	NP-5
	21-60	Silt loam, very fine sandy loam.	ML	A-4	0	95-100	95-100	85-100	70-90	25-30	NP-5
73E---------------- Waterbury	0-9	Extremely stony silt loam.	ML	A-6	25-70	80-95	75-90	70-90	55-80	35-40	10-15
	9-17	Very cobbly clay	CH	A-7	40-75	65-90	60-85	55-85	50-80	50-60	25-35
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
74F*:											
Waterbury---------	0-9	Extremely stony silt loam.	ML	A-6	25-70	80-95	75-90	70-90	55-80	35-40	10-15
	9-17	Very cobbly clay	CH	A-7	40-75	65-90	60-85	55-85	50-80	50-60	25-35
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
75B, 75C, 75D------ Willis	0-12	Silt loam-------	ML	A-4	0	100	100	90-100	75-90	20-30	NP-5
	12-35	Silt loam-------	ML	A-4	0	100	100	90-100	75-90	20-30	NP-5
	35	Indurated-------	---	---	---	---	---	---	---	---	---
76B---------------- Winchester	0-18	Sand------------	SM	A-1, A-2	0-5	95-100	95-100	35-55	10-20	---	NP
	18-60	Coarse sand, sand.	SM, SP-SM	A-1, A-3	0-5	95-100	95-100	30-55	0-10	---	NP
77F*:											
Wrentham----------	0-4	Silt loam-------	ML	A-4	0-10	90-100	85-100	85-100	75-90	30-35	NP-5
	4-32	Very cobbly silt loam, very gravelly silt loam, very cobbly silty clay loam.	GM, ML	A-2, A-4	30-65	35-90	25-85	20-85	20-75	30-35	NP-5
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
78*. Xeric Torriorthents											

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* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
1*:											
Aquepts.											
Aquolls.											
2D---------------	0-2	15-25	1.25-1.35	0.2-0.6	0.06-0.14	6.1-7.3	Low-----------	0.15	1	---	---
Bakeoven	2-7	18-33	1.30-1.40	0.2-0.6	0.05-0.14	6.6-7.8	Moderate-----	0.20			
	7	---	---	---	---	---	-------------	----			
3D*:											
Bakeoven---------	0-2	15-25	1.25-1.35	0.2-0.6	0.06-0.14	6.1-7.3	Low-----------	0.15	1	---	---
	2-7	18-33	1.30-1.40	0.2-0.6	0.05-0.14	6.6-7.8	Moderate-----	0.20			
	7	---	---	---	---	---	-------------	----			
Morrow-----------	0-9	18-25	1.25-1.35	0.6-2.0	0.19-0.21	6.6-7.3	Low-----------	0.37	2	---	1-2
	9-14	27-35	1.30-1.40	0.2-0.6	0.19-0.21	6.6-7.8	Moderate-----	0.43			
	14-26	18-30	1.30-1.50	0.6-2.0	0.19-0.21	7.9-8.4	Low-----------	0.43			
	26	---	---	---	---	---	-------------	----			
4D*:											
Bakeoven---------	0-2	15-25	1.25-1.35	0.2-0.6	0.06-0.14	6.1-7.3	Low-----------	0.15	1	---	---
	2-7	18-33	1.30-1.40	0.2-0.6	0.05-0.14	6.6-7.8	Moderate-----	0.20			
	7	---	---	---	---	---	-------------	----			
Valby------------	0-8	15-20	1.25-1.35	0.6-2.0	0.19-0.21	6.6-7.8	Low-----------	0.43	2	---	<2
	8-30	18-24	1.30-1.40	0.6-2.0	0.19-0.21	6.6-8.4	Low-----------	0.49			
	30	---	---	---	---	---	-------------	----			
5E---------------	0-14	10-20	0.75-0.85	2.0-6.0	0.23-0.25	6.1-7.3	Low-----------	0.37	5	---	---
Boardtree	14-25	10-20	0.75-0.85	2.0-6.0	0.23-0.25	6.1-7.3	Low-----------	0.37			
	25-60	35-60	1.15-1.25	<0.06	0.13-0.16	6.1-7.3	High----------	0.20			
6C---------------	0-2	18-22	---	0.6-2.0	0.10-0.12	6.1-6.5	Low-----------	0.24	1	---	1-2
Bocker	2-8	20-24	---	0.6-2.0	0.09-0.11	6.6-7.3	Low-----------	0.20			
	8	---	---	---	---	---	-------------	----			
7C*:											
Bocker-----------	0-2	18-22	---	0.6-2.0	0.10-0.12	6.1-6.5	Low-----------	0.24	1	---	1-2
	2-8	20-24	---	0.6-2.0	0.09-0.11	6.6-7.3	Low-----------	0.20			
	8	---	---	---	---	---	-------------	----			
Wrightman--------	0-12	18-25	1.25-1.35	0.6-2.0	0.15-0.21	6.1-7.3	Moderate-----	0.37	2	---	---
	12-26	18-30	1.25-1.40	0.6-2.0	0.15-0.21	6.1-7.3	Moderate-----	0.37			
	26	---	---	---	---	---	-------------	----			
8B, 8C-----------	0-5	0-5	---	6.0-20	0.11-0.15	6.6-7.8	Low-----------	0.24	2	2	.5-1
Burbank	5-20	0-5	---	6.0-20	0.10-0.14	6.6-8.4	Low-----------	0.24			
	20-34	0-4	---	6.0-20	0.04-0.07	6.6-8.4	Low-----------	0.20			
	34-60	0-2	---	>20	0.01-0.03	7.4-8.4	Low-----------	0.10			
9*.											
Dune land											
10B, 10C---------	0-13	2-8	1.35-1.50	0.6-2.0	0.13-0.15	7.4-7.8	Low-----------	0.32	2	3	.5-1
Ellum	13-28	2-8	1.35-1.50	2.0-6.0	0.07-0.09	7.4-8.4	Low-----------	0.17			
	28	---	---	---	---	---	-------------	----			
11---------------	0-12	8-17	1.30-1.40	2.0-6.0	0.14-0.16	6.6-8.4	Low-----------	0.32	3	---	1-3
Endersby	12-36	8-17	1.30-1.40	2.0-6.0	0.14-0.18	6.6-8.4	Low-----------	0.32			
	36-60	5-15	1.40-1.50	2.0-6.0	0.10-0.14	6.6-8.4	Low-----------	0.28			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
12	0-17	2-6	---	0.6-2.0	0.19-0.25	6.6-7.8	Low	0.43	5	5	1-2
Esquatzel	17-60	3-7	---	0.6-2.0	0.19-0.23	7.4-8.4	Low	0.43			
13D, 13E	0-7	8-17	1.25-1.35	0.06-2.0	0.06-0.10	7.9-8.4	Low	0.20	1	---	---
Gravden	7-14	8-17	1.25-1.35	0.06-2.0	0.03-0.08	7.9-8.4	Low	0.15			
	14	---	---	---	---	---	---	---			
14E	0-3	15-25	1.25-1.35	0.6-2.0	0.08-0.11	6.6-7.3	Low	0.28	1	---	---
Gwin	3-15	23-35	1.20-1.35	0.2-0.6	0.07-0.11	6.6-7.3	Low	0.24			
	15	---	---	---	---	---	---	---			
15F*:											
Gwin	0-3	15-25	1.25-1.35	0.6-2.0	0.08-0.11	6.6-7.3	Low	0.28	1	---	---
	3-15	23-35	1.20-1.35	0.2-0.6	0.07-0.11	6.6-7.3	Low	0.24			
	15	---	---	---	---	---	---	---			
Rock outcrop.											
16C	0-7	18-25	1.25-1.35	0.6-2.0	0.16-0.21	6.1-6.5	Low	0.32	2	---	---
Hall Ranch	7-23	18-27	1.30-1.60	0.6-2.0	0.11-0.19	6.6-7.3	Low	0.24			
	23	---	---	---	---	---	---	---			
17E	0-7	18-25	1.40-1.50	0.6-2.0	0.14-0.19	6.1-6.5	Low	0.28	2	---	---
Hall Ranch	7-23	18-27	1.30-1.60	0.6-2.0	0.11-0.19	6.6-7.3	Low	0.24			
	23	---	---	---	---	---	---	---			
18E	0-12	20-35	1.25-1.35	0.2-0.6	0.11-0.21	6.1-7.3	Moderate	0.32	4	---	---
Hankins	12-60	45-60	1.15-1.25	0.06-0.2	0.10-0.14	6.1-7.8	High	0.20			
19C, 19E, 19F	0-26	5-10	0.50-0.85	0.6-2.0	0.24-0.38	6.6-7.3	Low	0.49	3	---	---
Helter	26-37	18-35	1.30-1.50	0.2-0.6	0.14-0.21	6.6-7.3	Low	0.55			
	37-55	18-27	1.30-1.50	0.2-0.6	0.09-0.18	6.6-7.3	Low	0.37			
	55	---	---	---	---	---	---	---			
20B, 20C	0-9	2-8	---	6.0-20	0.13-0.15	6.6-8.4	Low	0.24	5	2	<.5
Hezel	9-30	2-8	---	6.0-20	0.08-0.12	6.6-9.0	Low	0.24			
	30-60	5-12	---	0.2-0.6	0.23-0.25	7.9-9.0	Low	0.43			
21B, 21C	0-3	5-10	1.30-1.45	0.6-2.0	0.13-0.15	6.6-7.3	Low	0.32	2	3	.5-1
Irrigon	3-23	5-10	1.30-1.40	0.6-2.0	0.16-0.18	6.6-7.3	Low	0.37			
	23	---	---	---	---	---	---	---			
22	0-15	10-18	1.25-1.35	2.0-6.0	0.11-0.17	6.6-7.8	Low	---	---	---	1-2
Kimberly	15-60	10-18	1.30-1.40	2.0-6.0	0.11-0.15	6.6-9.0	Low	---			
23D	0-11	12-18	---	0.6-2.0	0.15-0.17	6.1-7.3	Low	0.28	2	---	2-4
Klicker	11-26	18-35	---	0.2-0.6	0.10-0.13	6.1-6.5	Moderate	0.20			
	26	---	---	---	---	---	---	---			
24E, 24F	0-11	12-18	---	0.6-2.0	0.15-0.17	6.1-7.3	Low	0.28	2	---	2-4
Klicker	11-26	18-35	---	0.2-0.6	0.10-0.13	6.1-6.5	Moderate	0.20			
	26	---	---	---	---	---	---	---			
25E, 25F	0-11	12-18	---	0.6-2.0	0.14-0.16	6.1-7.3	Low	0.24	2	---	1-2
Klicker	11-26	18-35	---	0.2-0.6	0.10-0.13	6.1-6.5	Moderate	0.20			
	26	---	---	---	---	---	---	---			
26B, 26C	0-4	0-5	---	6.0-20	0.09-0.15	7.4-8.4	Low	0.17	2	2	---
Koehler	4-28	0-5	---	6.0-20	0.06-0.11	7.9-8.4	Low	0.17			
	28	---	---	<0.06	---	---	---	---			
27E	0-14	10-18	1.10-1.35	0.6-2.0	0.10-0.14	6.1-6.5	Low	0.28	3	---	---
Labuck	14-31	10-18	1.20-1.35	0.6-2.0	0.06-0.12	5.6-6.5	Low	0.24			
	31	---	---	---	---	---	---	---			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
28E Lickskillet	0-2	15-25	1.25-1.35	0.6-2.0	0.08-0.14	6.1-7.3	Low	0.17	1	---	---
	2-17	23-33	1.30-1.40	0.6-2.0	0.06-0.14	6.6-7.3	Low	0.24			
	17	---	---	---	---	---	---	----			
29F*: Lickskillet	0-2	15-25	1.25-1.35	0.6-2.0	0.08-0.14	6.1-7.3	Low	0.17	1	---	---
	2-17	23-33	1.30-1.40	0.6-2.0	0.06-0.14	6.6-7.3	Low	0.24			
	17	---	---	---	---	---	---	----			
Rock outcrop.											
30B, 30C, 30D Mikkalo	0-13	8-12	1.25-1.35	0.6-2.0	0.19-0.21	6.6-7.8	Low	0.43	2	---	1-2
	13-35	8-12	1.30-1.40	0.6-2.0	0.18-0.20	7.4-8.4	Low	0.49			
	35	---	---	---	---	---	---	----			
31B, 31C, 32D, 32E, 33D, 33E Morrow	0-9	18-25	1.25-1.35	0.6-2.0	0.19-0.21	6.6-7.3	Low	0.37	2	---	1-2
	9-14	27-35	1.30-1.40	0.2-0.6	0.19-0.21	6.6-7.8	Moderate	0.43			
	14-26	18-30	1.30-1.50	0.6-2.0	0.19-0.21	7.9-8.4	Low	0.43			
	26	---	---	---	---	---	---	----			
34F Nansene	0-25	10-18	1.25-1.35	0.6-2.0	0.16-0.19	6.1-7.3	Low	0.43	3	---	---
	25-45	10-18	1.30-1.40	0.6-2.0	0.16-0.19	6.1-8.4	Low	0.55			
	45	---	---	---	---	---	---	----			
35 Onyx	0-26	12-17	1.25-1.35	0.6-2.0	0.18-0.22	6.6-7.8	Low	0.37	5	5	1-2
	26-39	12-17	1.25-1.35	0.6-2.0	0.18-0.22	6.6-7.8	Low	0.37			
	39-60	12-17	1.25-1.35	0.6-2.0	0.08-0.14	6.6-7.8	Low	0.15			
36 Pedigo	0-10	10-17	1.25-1.35	0.6-2.0	0.19-0.20	7.4-9.0	Low	----	---	5	1-2
	10-66	10-17	1.25-1.40	0.6-2.0	0.19-0.20	6.6-9.0	Low	----			
37A, 37B Prosser	0-4	5-12	---	0.6-2.0	0.16-0.23	6.6-8.4	Low	0.55	2	3	.5-1
	4-29	5-12	---	0.6-2.0	0.16-0.22	6.6-8.4	Low	0.55			
	29	---	---	---	---	---	---	----			
38D*: Prosser	0-4	5-12	---	0.6-2.0	0.16-0.23	6.6-8.4	Low	0.55	2	3	.5-1
	4-29	5-12	---	0.6-2.0	0.16-0.22	6.6-8.4	Low	0.55			
	29	---	---	---	---	---	---	----			
Rock outcrop.											
39C, 40C Quincy	0-6	0-4	1.40-1.60	6.0-20.0	0.06-0.09	6.1-8.4	Low	0.17	5	1	<.5-.8
	6-60	0-4	1.40-1.60	6.0-20.0	0.06-0.09	6.1-8.4	Low	0.17			
41B Quinton	0-30	0-5	1.50-1.70	6.0-20	0.06-0.09	6.6-7.3	Low	0.17	2	2	<.8
	30-37	0-5	1.50-1.70	6.0-20	0.05-0.08	6.6-7.8	Low	0.10			
	37	---	---	---	---	---	---	----			
42D*: Quinton	0-30	0-5	1.50-1.70	6.0-20	0.06-0.09	6.6-7.3	Low	0.17	2	2	<.8
	30-37	0-5	1.50-1.70	6.0-20	0.05-0.08	6.6-7.8	Low	0.10			
	37	---	---	---	---	---	---	----			
Rock outcrop.											
43B, 43C, 43D, 43E, 43F Rhea	0-14	18-24	1.25-1.35	0.6-2.0	0.20-0.25	6.6-7.3	Low	0.43	5	---	1-2
	14-60	18-24	1.30-1.50	0.6-2.0	0.20-0.25	6.6-9.0	Moderate	0.49			
44B, 44C, 44D Ritzville	0-13	8-15	1.25-1.30	0.6-2.0	0.17-0.20	6.6-7.8	Low	0.49	5	4	1-2
	13-33	8-15	1.30-1.35	0.6-2.0	0.17-0.20	6.6-8.4	Low	0.55			
	33-70	8-15	1.35-1.40	0.6-2.0	0.17-0.20	7.9-9.0	Low	0.55			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
45A, 45B, 45C, 45D, 46E, 47E---	0-13	8-15	1.25-1.30	0.6-2.0	0.17-0.20	6.6-7.8	Low----------	0.49	5	5	1-2
Ritzville	13-33	8-15	1.30-1.35	0.6-2.0	0.17-0.20	6.6-8.4	Low----------	0.55			
	33-70	8-15	1.35-1.40	0.6-2.0	0.17-0.20	7.9-9.0	Low----------	0.55			
48*. Riverwash											
49F*: Rock outcrop.											
Rubble land.											
50D--------------	0-6	20-27	1.25-1.35	0.6-2.0	0.12-0.16	6.1-7.3	Low----------	0.10	1	---	---
Rockly	6-9	20-30	1.30-1.40	0.2-0.6	0.06-0.11	6.1-7.3	Low----------	0.10			
	9	---	---	---	---	---	-------------	----			
51B, 51C---------	0-6	2-8	1.20-1.30	6.0-20	0.13-0.17	7.4-8.4	Low----------	0.37	5	2	.5-1
Royal	6-14	5-12	1.40-1.60	2.0-6.0	0.18-0.22	7.4-8.4	-------------	0.37			
	14-60	3-12	1.40-1.70	---	0.20-0.24	7.4-9.0	Low----------	0.37			
52B, 52C, 52D----	0-6	5-12	1.40-1.50	2.0-6.0	0.18-0.22	7.4-8.4	Low----------	0.37	5	2	.5-1
Royal	6-17	5-12	1.40-1.60	2.0-6.0	0.18-0.22	7.4-8.4	-------------	0.37			
	17-60	3-12	1.40-1.70	---	0.20-0.24	7.4-9.0	Low----------	0.37			
53A--------------	0-6	5-12	1.30-1.40	2.0-6.0	0.18-0.22	7.4-8.4	Low----------	0.37	5	3	.5-1
Royal	6-33	5-12	1.40-1.60	2.0-6.0	0.18-0.22	7.4-8.4	-------------	0.37			
	33-60	3-12	1.40-1.70	---	0.20-0.24	7.4-9.0	Low----------	0.37			
54B, 54C, 54D, 55B, 55C--------	0-5	2-8	1.30-1.40	2.0-6.0	0.13-0.23	6.6-8.4	Low----------	0.43	5	3	<.5
Sagehill	5-28	2-8	1.30-1.60	2.0-6.0	0.13-0.20	6.6-8.4	Low----------	0.49			
	28-60	2-8	1.30-1.60	0.6-2.0	0.20-0.25	7.9-9.0	Low----------	0.55			
56F--------------	0-14	18-35	1.35-1.50	0.6-2.0	0.08-0.11	6.1-7.3	Low----------	0.10	2	---	---
Snell	14-30	35-45	1.15-1.25	0.2-0.6	0.05-0.10	6.1-7.3	High---------	0.10			
	30	---	---	---	---	---	-------------	----			
57---------------	0-33	18-22	1.25-1.35	0.6-2.0	0.18-0.20	6.6-7.8	Low----------	0.28	5	5	2-3
Snow	33-46	18-27	1.25-1.40	0.6-2.0	0.18-0.20	6.6-7.8	Low----------	0.28			
	46-60	18-27	1.25-1.40	0.6-2.0	0.18-0.20	6.6-7.8	Low----------	0.28			
58A, 58B, 58C, 59B-------------	0-5	5-8	1.40-1.55	2.0-6.0	0.14-0.16	7.9-8.4	Low----------	0.37	2	3	.5-1
Taunton	5-32	5-8	1.40-1.55	2.0-6.0	0.14-0.16	7.9-9.0	Low----------	----			
	32	---	---	---	---	---	-------------	----			
60C, 60E, 60F----	0-25	5-10	0.75-0.85	0.6-2.0	0.24-0.38	5.6-7.3	Low----------	0.49	5	---	---
Tolo	25-41	18-35	1.20-1.40	0.2-0.6	0.15-0.24	5.6-7.3	Moderate-----	0.55			
	41-60	30-35	1.20-1.40	0.2-0.6	0.10-0.14	5.6-7.3	Moderate-----	0.37			
61E--------------	0-3	30-35	---	0.06-0.2	0.16-0.18	6.6-7.3	Moderate-----	0.25	2	---	---
Ukiah	3-26	50-60	---	<0.06	0.09-0.14	6.6-7.3	High---------	0.28			
	26	---	---	---	---	---	-------------	----			
62D--------------	0-16	18-30	1.25-1.35	0.6-2.0	0.15-0.18	6.1-7.3	Low----------	0.28	5	---	---
Utley	16-38	18-30	1.25-1.40	0.6-2.0	0.14-0.17	6.1-7.3	Low----------	0.32			
	38-60	18-30	1.25-1.40	0.6-2.0	0.08-0.10	6.1-7.3	Low----------	0.37			
63B, 63C, 64D, 65D, 65E--------	0-8	15-20	1.25-1.35	0.6-2.0	0.19-0.21	6.6-7.8	Low----------	0.43	2	---	<2
Valby	8-30	18-24	1.30-1.40	0.6-2.0	0.19-0.21	6.6-8.4	Low----------	0.49			
	30	---	---	---	---	---	-------------	----			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
66B, 67D, 67E, 68D--------------	0-12	10-15	---	0.6-2.0	0.18-0.21	6.1-7.3	Low----------	0.32	2	---	2-3
Waha	12-27	20-32	---	0.2-0.6	0.18-0.21	6.6-7.3	Moderate-----	0.37			
	27-29	25-35	---	0.2-0.6	0.06-0.09	6.6-7.3	Moderate-----	0.24			
	29	---	---	---	---	---	-------------	-----			
69D*:											
Waha------------	0-12	10-15	---	0.6-2.0	0.18-0.21	6.1-7.3	Low----------	0.32	2	---	2-3
	12-27	20-32	---	0.2-0.6	0.18-0.21	6.6-7.3	Moderate-----	0.37			
	27-29	25-35	---	0.2-0.6	0.06-0.09	6.6-7.3	Moderate-----	0.24			
	29	---	---	---	---	---	-------------	-----			
Rockly----------	0-2	20-27	1.25-1.35	0.6-2.0	0.12-0.16	6.1-7.3	Low----------	0.10	1	---	---
	2-9	20-30	1.30-1.40	0.2-0.6	0.06-0.11	6.1-7.3	Low----------	0.10			
	9	---	---	---	---	---	-------------	-----			
70B, 70C, 70D----	0-5	8-15	1.30-1.40	0.6-2.0	0.19-0.21	6.6-7.8	Low----------	0.55	5	4	1-2.
Warden	5-20	8-15	1.30-1.40	0.6-2.0	0.16-0.20	6.6-8.4	Low----------	0.55			
	20-60	8-15	1.35-1.45	0.6-2.0	0.19-0.21	7.9-9.0	Low----------	0.55			
71A, 71B, 71C, 71D, 71E--------	0-5	8-15	1.30-1.40	0.6-2.0	0.19-0.21	6.6-7.8	Low----------	0.55	5	5	1-2.
Warden	5-25	8-15	1.30-1.40	0.6-2.0	0.16-0.20	6.6-8.4	Low----------	0.55			
	25-60	8-15	1.35-1.45	0.6-2.0	0.19-0.21	7.9-9.0	Low----------	0.55			
72C, 72D---------	0-1	8-15	1.30-1.40	0.6-2.0	0.19-0.21	6.6-7.8	Low----------	0.55	5	5	1-2.
Warden	1-21	8-15	1.30-1.40	0.6-2.0	0.16-0.20	6.6-8.4	Low----------	0.55			
	21-60	8-15	1.35-1.45	0.6-2.0	0.19-0.21	7.9-9.0	Low----------	0.55			
73E--------------	0-9	18-27	1.15-1.25	0.6-2.0	0.09-0.17	6.6-7.3	Low----------	0.28	1	---	---
Waterbury	9-17	50-60	1.15-1.25	<0.06	0.04-0.10	6.6-7.3	High---------	0.17			
	17	---	---	---	---	---	-------------	-----			
74F*:											
Waterbury-------	0-9	18-27	1.15-1.25	0.6-2.0	0.09-0.17	6.6-7.3	Low----------	0.28	1	---	---
	9-17	50-60	1.15-1.25	<0.06	0.04-0.10	6.6-7.3	High---------	0.17			
	17	---	---	---	---	---	-------------	-----			
Rock outcrop.											
75B, 75C, 75D----	0-12	10-15	---	0.6-2.0	0.19-0.21	7.4-7.8	Low----------	0.49	2	5	1-1.
Willis	12-35	10-15	---	0.6-2.0	0.19-0.21	7.9-9.0	Low----------	0.55			
	35	---	---	<0.06	---	---	-------------	-----			
76B--------------	0-18	0-5	1.50-1.70	6.0-20	0.05-0.07	6.1-8.4	Low----------	0.10	5	1	<.5
Winchester	18-60	0-5	1.50-1.70	6.0-20	0.05-0.07	6.6-8.4	Low----------	0.10			
77F*:											
Wrentham--------	0-4	15-25	---	0.6-2.0	0.15-0.21	6.1-7.3	Low----------	0.37	2	---	---
	4-32	18-35	---	0.2-0.6	0.09-0.14	6.6-7.3	Low----------	0.20			
	32	---	---	---	---	---	-------------	-----			
Rock outcrop.											
78*. Xeric Torriorthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

[See text for descriptions of symbols and such terms as "rare" and "brief." The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness		Uncoated steel	Concrete
					In		In				
1*: Aquepts.											
Aquolls.											
2D Bakeoven	D	None	---	---	5-12	Hard	---	---	Moderate	Moderate	Low.
3D*: Bakeoven	D	None	---	---	5-12	Hard	---	---	Moderate	Moderate	Low.
Morrow	C	None	---	---	20-40	Hard	---	---	High	High	Low.
4D*: Bakeoven	D	None	---	---	5-12	Hard	---	---	Moderate	Moderate	Low.
Valby	C	None	---	---	20-40	Hard	---	---	High	Moderate	Low.
5E Boardtree	C	None	---	---	>60	---	---	---	Low	High	Low.
6C Bocker	D	None	---	---	4-10	Hard	---	---	Moderate	Low	Low.
7C*: Bocker	D	None	---	---	4-10	Hard	---	---	Moderate	Low	Low.
Wrightman	C	None	---	---	20-40	Hard	---	---	Moderate	Moderate	Low.
8B, 8C Burbank	A	None	---	---	>60	---	---	---	Low	High	Low.
9*. Dune land											
10B, 10C Ellum	C	None	---	---	>60	---	20-40	Rippable	Moderate	High	Low.
11 Endersby	B	Rare	---	---	>60	---	---	---	Moderate	Moderate	Low.
12 Esquatzel	B	Rare	Brief	Mar-Apr	>60	---	---	---	Moderate	High	Low.
13D, 13E Gravden	D	None	---	---	>60	---	10-20	Rippable	Moderate	Moderate	Low.
14E Gwin	D	None	---	---	10-20	Hard	---	---	Moderate	Moderate	Low.
15F*: Gwin	D	None	---	---	10-20	Hard	---	---	Moderate	Moderate	Low.
Rock outcrop.											
16C, 17E Hall Ranch	C	None	---	---	20-40	Rippable	---	---	Moderate	Moderate	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			Bedrock		Cemented pan		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hard-ness	Depth	Hard-ness		Uncoated steel	Concrete
					In		In				
18E Hankins	C	None	---	---	>60	---	---	---	Moderate	High	Low.
19C, 19E, 19F Helter	B	None	---	---	40-60	Hard	---	---	High	Moderate	Moderate.
20B, 20C Hezel	B	None	---	---	>60	---	---	---	Low	Moderate	Low.
21B, 21C Irrigon	C	None	---	---	20-40	Rip-pable	---	---	Moderate	Moderate	Low.
22 Kimberly	B	Rare	Brief	Dec-Mar	>60	---	---	---	Low	Moderate	Low.
23D, 24E, 24F, 25E, 25F Klicker	C	None	---	---	20-40	Hard	---	---	Moderate	Moderate	Low.
26B, 26C Koehler	C	None	---	---	>60	---	20-40	Rip-pable	Low	Moderate	Low.
27E Labuck	B	None	---	---	20-40	Rip-pable	---	---	Moderate	Low	Moderate.
28E Lickskillet	D	None	---	---	12-20	Hard	---	---	Moderate	Moderate	Low.
29F*:											
Lickskillet	D	None	---	---	12-20	Hard	---	---	Moderate	Moderate	Low.
Rock outcrop.											
30B, 30C, 30D Mikkalo	C	None	---	---	20-40	Hard	---	---	Moderate	Low	Low.
31B, 31C, 32D, 32E, 33D, 33E Morrow	C	None	---	---	20-40	Hard	---	---	High	High	Low.
34F Nansene	B	None	---	---	40-60	Hard	---	---	High	Moderate	Low.
35 Onyx	B	Rare	Brief	Jan-Apr	>60	---	---	---	High	Moderate	Low.
36 Pedigo	C	Rare	Long	Nov-May	>60	---	---	---	High	High	Low.
37A, 37B Prosser	C	None	---	---	20-40	Hard	---	---	Moderate	High	Low.
38D*:											
Prosser	C	None	---	---	20-40	Hard	---	---	Moderate	High	Low.
Rock outcrop.											
39C, 40C Quincy	A	None	---	---	>60	---	---	---	Low	Low	Low.
41B Quinton	C	None	---	---	20-40	Hard	---	---	Low	Low	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness		Uncoated steel	Concrete
					In		In				
42D*:											
Quinton----------	C	None--------	---	---	20-40	Hard	---	---	Low------	Low------	Low.
Rock outcrop.											
43B, 43C, 43D, 43E, 43F--------- Rhea	B	None--------	---	---	>60	---	---	---	High-----	Moderate	Low.
44B, 44C, 44D, 45A, 45B, 45C, 45D, 46E, 47E---- Ritzville	B	None--------	---	---	>60	---	---	---	High-----	High-----	Low.
48*. Riverwash											
49F*:											
Rock outcrop.											
Rubble land.											
50D--------------- Rockly	D	None--------	---	---	5-12	Hard	---	---	Moderate	Low------	Low.
51B, 51C, 52B, 52C, 52D, 53A---- Royal	B	None--------	---	---	>60	---	---	---	Moderate	High-----	Low.
54B, 54C, 54D, 55B, 55C--------- Sagehill	B	None--------	---	---	>60	---	---	---	Moderate	High-----	Low.
56F--------------- Snell	C	None--------	---	---	20-40	Hard	---	---	Moderate	High-----	Low.
57---------------- Snow	B	Rare--------	---	---	>60	---	---	---	High-----	Moderate	Low.
58A, 58B, 58C, 59B-------------- Taunton	C	None--------	---	---	>60	---	20-40	Hard	Moderate	High-----	Low.
60C, 60E, 60F----- Tolo	B	None--------	---	---	>60	---	---	---	High-----	Moderate	Moderate.
61E--------------- Ukiah	C	None--------	---	---	20-40	Rippable	---	---	Low------	High-----	Low.
62D--------------- Utley	B	None--------	---	---	>60	---	---	---	Moderate	Moderate	Low.
63B, 63C, 64D, 65D, 65E--------- Valby	C	None--------	---	---	20-40	Hard	---	---	High-----	Moderate	Low.
66B, 67D, 67E, 68D-------------- Waha	C	None--------	---	---	20-40	Hard	---	---	Moderate	Moderate	Low.
69D*:											
Waha-------------	C	None--------	---	---	20-40	Hard	---	---	Moderate	Moderate	Low.
Rockly-----------	D	None--------	---	---	5-12	Hard	---	---	Moderate	Low------	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Cemented pan		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness		Uncoated steel	Concrete
					In		In				
70B, 70C, 70D, 71A, 71B, 71C, 71D, 71E, 72C, 72D Warden	B	None	---	---	>60	---	---	---	Moderate	High	Low.
73E Waterbury	D	None	---	---	12-20	Hard	---	---	Moderate	High	Low.
74F*:											
Waterbury	D	None	---	---	12-20	Hard	---	---	Moderate	High	Low.
Rock outcrop.											
75B, 75C, 75D Willis	C	None	---	---	>60	---	20-40	Rippable	Moderate	High	Low.
76B Winchester	A	None	---	---	>60	---	---	---	Low	Moderate	Low.
77F*:											
Wrentham	C	None	---	---	20-40	Hard	---	---	Moderate	Moderate	Low.
Rock outcrop.											
78*. Xeric Torriorthents											

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* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Bakeoven	Loamy-skeletal, mixed, mesic Lithic Haploxerolls
Boardtree	Medial over clayey, mixed, frigid Typic Vitrandepts
Bocker	Loamy-skeletal, mixed, frigid Lithic Haploxerolls
Burbank	Sandy-skeletal, mixed, mesic Xeric Torriorthents
Ellum	Loamy-skeletal, mixed, mesic Haploxerollic Durorthids
Endersby	Coarse-loamy, mixed, mesic Cumulic Haploxerolls
Esquatzel	Coarse-silty, mixed, mesic Torrifluventic Haploxerolls
Gravden	Loamy-skeletal, mixed, mesic, shallow Haploxerollic Durorthids
Gwin	Loamy-skeletal, mixed, mesic Lithic Argixerolls
Hall Ranch	Fine-loamy, mixed, frigid Ultic Haploxerolls
Hankins	Fine, montmorillonitic, frigid Ultic Palexerolls
Helter	Medial over loamy, mixed Entic Cryandepts
Hezel	Sandy over loamy, mixed, nonacid, mesic Xeric Torriorthents
Irrigon	Coarse-loamy, mixed, mesic Xerollic Camborthids
Kimberly	Coarse-loamy, mixed, mesic Torrifluventic Haploxerolls
Klicker	Loamy-skeletal, mixed, frigid Ultic Argixerolls
Koehler	Sandy, mixed, mesic Xerollic Durorthids
Labuck	Coarse-loamy, mixed, frigid Typic Xerochrepts
Lickskillet	Loamy-skeletal, mixed, mesic Lithic Haploxerolls
Mikkalo	Coarse-silty, mixed, mesic Calciorthidic Haploxerolls
Morrow	Fine-silty, mixed, mesic Calcic Argixerolls
Nansene	Coarse-silty, mixed, mesic Pachic Haploxerolls
Onyx	Coarse-silty, mixed, mesic Cumulic Haploxerolls
Pedigo	Coarse-silty, mixed, mesic Cumulic Haploxerolls
Prosser	Coarse-loamy, mixed, mesic Xerollic Camborthids
Quincy	Mixed, mesic Xeric Torripsamments
Quinton	Mixed, mesic Xeric Torripsamments
Rhea	Fine-silty, mixed, mesic Calcic Haploxerolls
Ritzville	Coarse-silty, mixed, mesic Calciorthidic Haploxerolls
Rockly	Loamy-skeletal, mixed, mesic Lithic Haploxerolls
Royal	Coarse-loamy, mixed, mesic Xerollic Camborthids
Sagehill	Coarse-loamy, mixed, mesic Xerollic Camborthids
Snell	Clayey-skeletal, montmorillonitic, frigid Pachic Argixerolls
Snow	Fine-silty, mixed, mesic Cumulic Haploxerolls
Taunton	Coarse-loamy, mixed, mesic Xerollic Durorthids
Tolo	Medial over loamy, mixed, frigid Typic Vitrandepts
Ukiah	Fine, montmorillonitic, mesic Vertic Argixerolls
Utley	Fine-loamy, mixed, frigid Pachic Haploxerolls
Valby	Fine-silty, mixed, mesic Calcic Haploxerolls
Waha	Fine-loamy, mixed, mesic Pachic Argixerolls
Warden	Coarse-silty, mixed, mesic Xerollic Camborthids
Waterbury	Clayey-skeletal, montmorillonitic, mesic Lithic Argixerolls
Willis	Coarse-silty, mixed, mesic Orthidic Durixerolls
Winchester	Mixed, mesic Xeric Torripsamments
Wrentham	Loamy-skeletal, mixed, mesic Pachic Haploxerolls
Wrightman	Fine-loamy, mixed, frigid Pachic Haploxerolls

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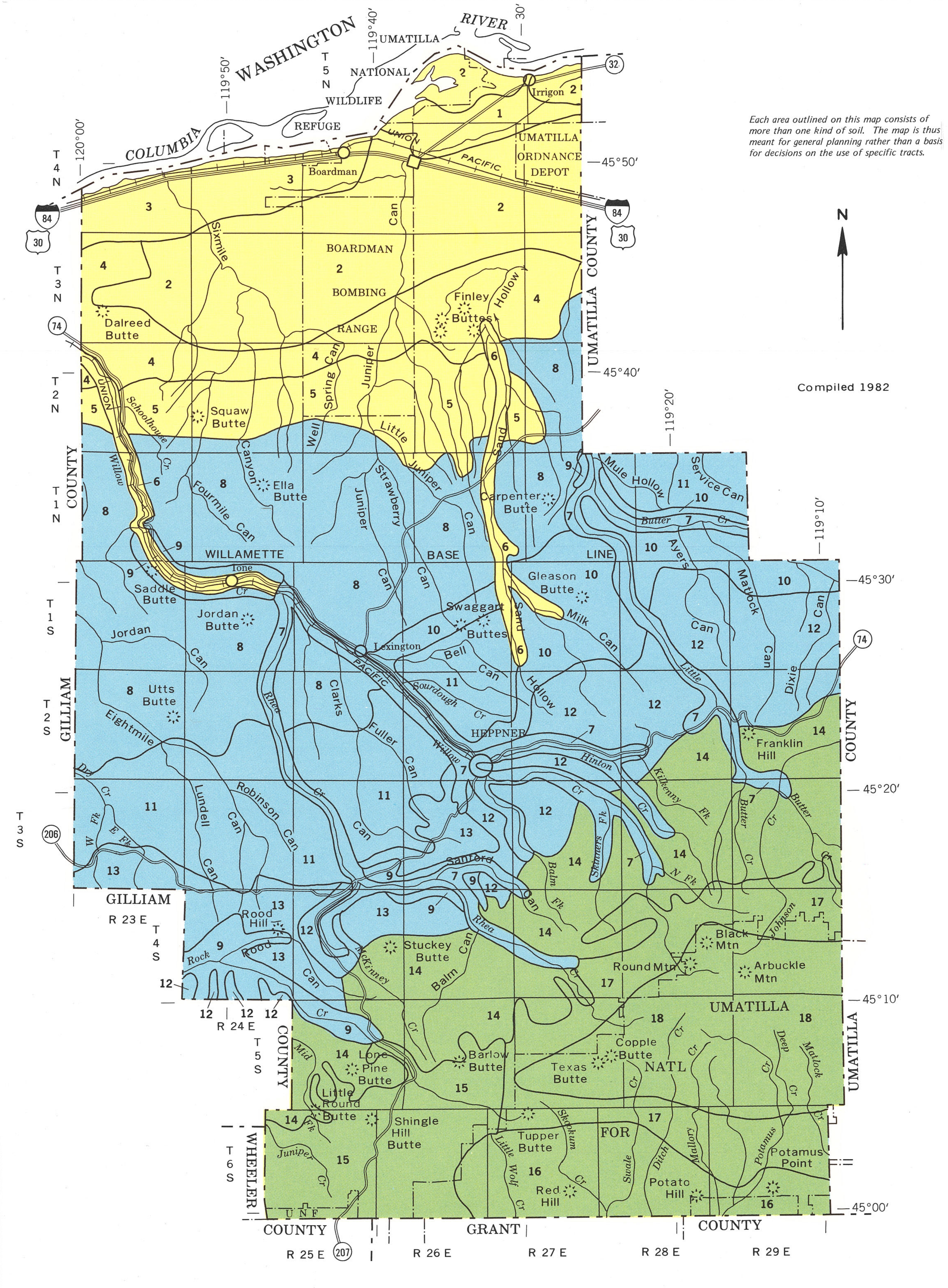
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Saddle Butte
Jordan Butte
Utts Butte
Ione
Lexington
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Rood Hill
Lone Pine Butte
Little Round Butte
Shingle Hill Butte
Barlow Butte
Copple Butte
Texas Butte
Tupper Butte
Red Hill
Potato Hill
Potamus Point
WILLAMETTE BASE LINE
UMATILLA NATL FOR
GILLIAM COUNTY
UMATILLA COUNTY
WHEELER COUNTY
GRANT COUNTY
T 5 N
T 4 N
T 3 N
T 2 N
T 1 N
T 1 S
T 2 S
T 3 S
T 4 S
T 5 S
T 6 S
R 23 E
R 24 E
R 25 E
R 26 E
R 27 E
R 28 E
R 29 E
119°50'
119°40'
119°30'
119°20'
119°10'
120°00'
45°50'
45°40'
45°30'
45°20'
45°10'
45°00'
84
30
32
74
206
207
N

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

Compiled 1982

SOIL ASSOCIATIONS

AREAS DOMINATED BY MODERATELY DEEP TO VERY DEEP, WELL DRAINED TO EXCESSIVELY DRAINED SOILS

1	Winchester: Very deep, excessively drained sands
2	Quincy-Koehler: Moderately deep and very deep, somewhat excessively drained loamy fine sands
3	Prosser: Moderately deep, well drained silt loams
4	Sagehill-Taunton: Moderately deep and very deep, well drained and somewhat excessively drained fine sandy loams
5	Warden: Very deep, well drained silt loams and very fine sandy loams
6	Xeric Torriorthents-Kimberly: Very deep, well drained and somewhat excessively drained sandy loams

AREAS DOMINATED BY SHALLOW TO VERY DEEP, WELL DRAINED AND SOMEWHAT EXCESSIVELY DRAINED SOILS

7	Onyx-Endersby: Very deep, well drained and somewhat excessively drained silt loams and fine sandy loams
8	Ritzville-Mikkalo-Willis: Moderately deep and very deep, well drained silt loams
9	Lickskillet-Wrentham: Shallow and moderately deep, well drained very stony loams and silt loams
10	Valby-Lickskillet-Bakeoven: Very shallow to moderately deep, well drained silt loams, very stony loams, and very cobbly loams
11	Valby-Rhea: Moderately deep and very deep, well drained silt loams
12	Morrow-Lickskillet-Bakeoven: Very shallow to moderately deep, well drained silt loams, very stony loams, and very cobbly loams
13	Morrow: Moderately deep, well drained silt loams

AREAS DOMINATED BY SHALLOW TO VERY DEEP, WELL DRAINED SOILS

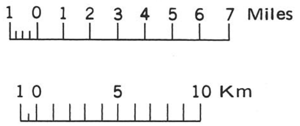
14	Waha-Waterbury-Rockly: Very shallow to moderately deep, well drained silt loams, extremely stony silt loams, and very gravelly loams
15	Hankins-Klicker-Boardtree: Moderately deep and very deep, well drained silt loams and stony silt loams
16	Klicker-Bocker-Hall Ranch: Very shallow and moderately deep, well drained stony silt loams, loams, and extremely cobbly silt loams
17	Tolo-Klicker-Hall Ranch: Moderately deep and very deep, well drained silt loams, stony silt loams, and loams
18	Helter-Klicker-Hall Ranch: Moderately deep and deep, well drained silt loams, stony silt loams, and loams

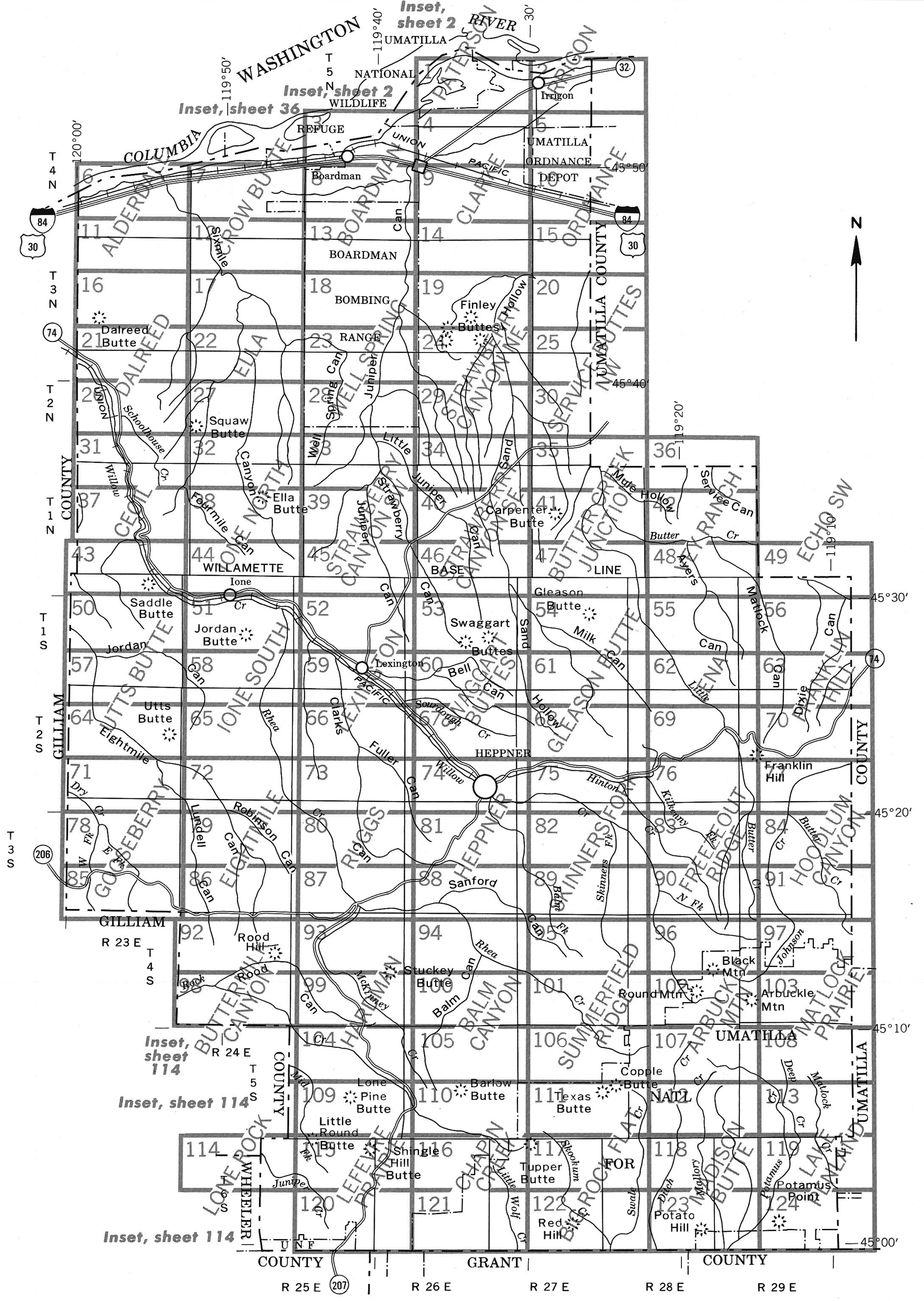
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OREGON AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

MORROW COUNTY, OREGON

Scale 1:443,520


1 0 1 2 3 4 5 6 7 Miles
1 0 5 10 Km


WASHINGTON
COLUMBIA
RIVER
Inset, sheet 2
Inset, sheet 2
Inset, sheet 36
UMATILLA NATIONAL WILDLIFE REFUGE
T 5 N
T 4 N
T 3 N
T 2 N
T 1 N
T 1 S
T 2 S
T 3 S
T 4 S
T 5 S
T 6 S
120°00′
119°50′
119°40′
30′
119°20′
119°10′
45°50′
45°40′
45°30′
45°20′
45°10′
45°00′
Boardman
Irrigon
UNION PACIFIC
UMATILLA ORDNANCE DEPOT
BOARDMAN BOMBING RANGE
84
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32
74
206
207
N
ALDERDALE
CROW BUTTE
BOARDMAN
PATERSON
IRRIGON
CLARKE
ORDNANCE
UMATILLA BUTTES NW
SERVICE
DALREED
ELLA
WELL SPRING
CANYON
Dalreed Butte
Finley Buttes
Squaw Butte
Ella Butte
Carpenter Butte
Sixmile Can
Well Spring Can
Juniper
Little Juniper
Sand Hollow
Willow
Schoolhouse Cr
Fourmile Can
Strawberry
Juniper Can
Butter Cr
Mule Hollow
Service Can
CECIL
IONE NORTH
STRAWBERRY CANYON
BUTTER CREEK JUNCTION
STRAWBERRY CANYON NE
STEPNEY RANCH
ECHO SW
WILLAMETTE BASE LINE
Ione
Cr
Gleason Butte
Saddle Butte
Jordan Butte
Swaggart Buttes
Lexington
Jordan
Can
Bell Can
Milk Can
Ayers Can
Matlock
Little Butter
Dixie Can
UTTS BUTTE
IONE SOUTH
LEXINGTON
SWAGGART BUTTES
GLEASON BUTTE
LENA
FRANKLIN HILL
Utts Butte
Eightmile
Rhea
Clarks
Fuller Can
Sowatnah Cr
Hollow
HEPPNER
Willow
Hinton Cr
Kilkenny
Franklin Hill
Dry Cr
W Fk
E Fk
Lundell Can
Robinson Can
Cr
GOOSEBERRY
EIGHTMILE
RIGGS
HEPPNER
SKINNERS FORK
FREEZEOUT RIDGE
HOODLUM CANYON
Sanford
Balm Fk
Skinners Fk
N Fk
Butter Cr
Butter Cr
GILLIAM COUNTY
GILLIAM
R 23 E
R 24 E
Rood Hill
Rock
Rood Can
Rhea Can
McKinney
Stuckey Butte
Balm Can
Black Mtn
Round Mtn
Arbuckle Mtn
Johnson
Rhea Cr
BUTTERBY CANYON
HARDMAN
BALM CANYON
SUMMERFIELD RIDGE
ARBUCKLE MTN
MATLOCK PRAIRIE
UMATILLA
Inset, sheet 114
Inset, sheet 114
Inset, sheet 114
Lone Pine Butte
Barlow Butte
Texas Butte
Copple Butte
NAT'L FOR
Little Round Butte
Shingle Hill Butte
Tupper Butte
Red Hill
Potato Hill
Potamus Point
Deer Cr
Matlock Cr
Juniper Cr
Mallory
Ditch
Potamus
Shobkum
Little Wolf Cr
Swale
LONE ROCK
LEFEVRE PRAIRIE
CHAPIN CREEK
ROCK FLAT
MADISON BUTTE
LAKE PENLAND
WHEELER COUNTY
UMATILLA COUNTY
UMATILLA
GRANT COUNTY
COUNTY
COUNTY
U N F
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R 26 E
R 27 E
R 28 E
R 29 E
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121
122
123
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INDEX TO MAP SHEETS

MORROW COUNTY, OREGON

Scale 1:443,520

1 0 1 2 3 4 5 6 7 Miles

10 0 5 10 Km

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MORROW COUNTY, OREGON

U.S. FOREST SERVICE
U.S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT
UNIVERSITY OF OREGON AGRICULTURAL RESEARCH CENTER

SOIL LEGEND

The legend is a slightly modified numerical legend. Arabic numerals in the symbols indicate the soil name except for slopes. The capital letters A, B, C, D, E, or F following the numeral or numerals indicate the slope class. Capital letters are omitted in symbols for nearly level soils and for other mapping units such as miscellaneous areas that may have a wide range in slope.

SYMBOL	NAME
1	Aquepts and Aquolls, nearly level
2D	Bakeoven very cobbly loam, 2 to 20 percent slopes
3D	Bakeoven-Morrow complex, 2 to 20 percent slopes
4D	Bakeoven-Valby complex, 2 to 20 percent slopes
5E	Boardtree loam, 7 to 40 percent slopes
6C	Bocker extremely cobbly silt loam, 2 to 12 percent slopes
7C	Bocker-Wrightman complex, 2 to 12 percent slopes
8B	Burbank loamy fine sand, 2 to 5 percent slopes
8C	Burbank loamy fine sand, 5 to 12 percent slopes
9	Dune land
10B	Ellum fine sandy loam, 2 to 5 percent slopes
10C	Ellum fine sandy loam, 5 to 12 percent slopes
11	Endersby fine sandy loam
12	Esquatzel silt loam
13D	Gravden very gravelly loam, 5 to 20 percent slopes
13E	Gravden very gravelly loam, 20 to 40 percent slopes
14E	Gwin extremely stony silt loam, 12 to 40 percent slopes
15F	Gwin-Rock outcrop complex, 40 to 70 percent slopes
16C	Hall Ranch loam, 2 to 12 percent slopes
17E	Hall Ranch gravelly loam, 12 to 35 percent slopes
18E	Hankins silt loam, 5 to 35 percent south slopes
19C	Helter silt loam, bedrock substratum, 3 to 15 percent slopes
19E	Helter silt loam, bedrock substratum, 15 to 35 percent slopes
19F	Helter silt loam, bedrock substratum, 35 to 60 percent slopes
20B	Hezel loamy fine sand, 2 to 5 percent slopes
20C	Hezel loamy fine sand, 5 to 12 percent slopes
21B	Irrigon fine sandy loam, 2 to 5 percent slopes
21C	Irrigon fine sandy loam, 5 to 12 percent slopes
22	Kimberly fine sandy loam
23D	Klicker stony silt loam, 2 to 20 percent slopes
24E	Klicker stony silt loam, 20 to 40 percent north slopes
24F	Klicker stony silt loam, 40 to 75 percent north slopes
25E	Klicker very stony silt loam, 20 to 40 percent south slopes
25F	Klicker very stony silt loam, 40 to 75 percent south slopes
26B	Koehler loamy fine sand, 2 to 5 percent slopes
26C	Koehler loamy fine sand, 5 to 12 percent slopes
27E	Labuck loam, 5 to 35 percent slopes
28E	Lickskillet very stony loam, 7 to 40 percent slopes
29F	Lickskillet-Rock outcrop complex, 40 to 70 percent slopes
30B	Mikkalo silt loam, 2 to 7 percent slopes
30C	Mikkalo silt loam, 7 to 12 percent slopes
30D	Mikkalo silt loam, 12 to 20 percent slopes
31B	Morrow silt loam, 1 to 7 percent slopes
31C	Morrow silt loam, 7 to 12 percent slopes
32D	Morrow silt loam, 12 to 20 percent north slopes
32E	Morrow silt loam, 20 to 35 percent north slopes
33D	Morrow silt loam, 12 to 20 percent south slopes
33E	Morrow silt loam, 20 to 30 percent south slopes
34F	Nansene silt loam, 35 to 70 percent slopes
35	Onyx silt loam
36	Pedigo silt loam
37A	Prosser silt loam, 0 to 2 percent slopes
37B	Prosser silt loam, 2 to 7 percent slopes
38D	Prosser-Rock outcrop complex, 1 to 20 percent slopes
39C	Quincy fine sand, 2 to 12 percent slopes
40C	Quincy loamy fine sand, 2 to 12 percent slopes
41B	Quinton loamy fine sand, 2 to 5 percent slopes
42D	Quinton-Rock outcrop complex, 2 to 20 percent slopes
43B	Rhea silt loam, 1 to 7 percent slopes
43C	Rhea silt loam, 7 to 12 percent slopes
43D	Rhea silt loam, 12 to 20 percent slopes
43E	Rhea silt loam, 20 to 35 percent slopes
43F	Rhea silt loam, 35 to 50 percent slopes
44B	Ritzville very fine sandy loam, 2 to 7 percent slopes
44C	Ritzville very fine sandy loam, 7 to 12 percent slopes
44D	Ritzville very fine sandy loam, 12 to 25 percent slopes
45A	Ritzville silt loam, 0 to 2 percent slopes
45B	Ritzville silt loam, 2 to 7 percent slopes
45C	Ritzville silt loam, 7 to 12 percent slopes
45D	Ritzville silt loam, 12 to 20 percent slopes
46E	Ritzville silt loam, 20 to 40 percent north slopes
47E	Ritzville silt loam, 20 to 40 percent south slopes
48	Riverwash
49F	Rock outcrop-Rubble land complex, very steep
50D	Rockly very gravelly loam, 2 to 20 percent slopes
51B	Royal loamy fine sand, 2 to 5 percent slopes
51C	Royal loamy fine sand, 5 to 12 percent slopes
52B	Royal fine sandy loam, 2 to 5 percent slopes
52C	Royal fine sandy loam, 5 to 12 percent slopes
52D	Royal fine sandy loam, 12 to 20 percent slopes
53A	Royal silt loam, 0 to 3 percent slopes
54B	Sagehill fine sandy loam, 2 to 5 percent slopes
54C	Sagehill fine sandy loam, 5 to 12 percent slopes
54D	Sagehill fine sandy loam, 12 to 20 percent slopes
55B	Sagehill fine sandy loam, hummocky, 2 to 5 percent slopes
55C	Sagehill fine sandy loam, hummocky, 5 to 12 percent slopes
56F	Snell very stony loam, 35 to 70 percent north slopes
57	Snow silt loam
58A	Taunton fine sandy loam, 0 to 2 percent slopes
58B	Taunton fine sandy loam, 2 to 5 percent slopes
58C	Taunton fine sandy loam, 5 to 12 percent slopes
59B	Taunton fine sandy loam, hummocky, 0 to 5 percent slopes
60C	Tolo silt loam, 3 to 15 percent slopes
60E	Tolo silt loam, 15 to 35 percent slopes
60F	Tolo silt loam, 35 to 60 percent slopes
61E	Ukiah stony silty clay loam, 5 to 30 percent slopes
62D	Utley loam, 8 to 20 percent slopes
63B	Valby silt loam, 1 to 7 percent slopes
63C	Valby silt loam, 7 to 12 percent slopes
64D	Valby silt loam, 12 to 20 percent north slopes
65D	Valby silt loam, 12 to 20 percent south slopes
65E	Valby silt loam, 20 to 30 percent south slopes
66B	Waha silt loam, 1 to 7 percent slopes
67D	Waha silt loam, 7 to 25 percent north slopes
67E	Waha silt loam, 25 to 40 percent north slopes
68D	Waha silt loam, 7 to 25 percent south slopes
69D	Waha-Rockly complex, 2 to 20 percent slopes
70B	Warden very fine sandy loam, 2 to 5 percent slopes
70C	Warden very fine sandy loam, 5 to 12 percent slopes
70D	Warden very fine sandy loam, 12 to 20 percent slopes
71A	Warden silt loam, 0 to 2 percent slopes
71B	Warden silt loam, 2 to 5 percent slopes
71C	Warden silt loam, 5 to 12 percent slopes
71D	Warden silt loam, 12 to 20 percent slopes
71E	Warden silt loam, 20 to 40 percent slopes
72C	Warden silt loam, 3 to 12 percent slopes, eroded
72D	Warden silt loam, 12 to 20 percent slopes, eroded
73E	Waterbury extremely stony silt loam, 7 to 40 percent slopes
74F	Waterbury-Rock outcrop complex, 40 to 70 percent slopes
75B	Willis silt loam, 2 to 5 percent slopes
75C	Willis silt loam, 5 to 12 percent slopes
75D	Willis silt loam, 12 to 20 percent slopes
76C	Winchester sand, 0 to 12 percent slopes
77F	Wrentham-Rock outcrop complex, 35 to 70 percent slopes
78	Xeric Torriorthents, nearly level

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Hedley Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water

PITS — w

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CnB WaC2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

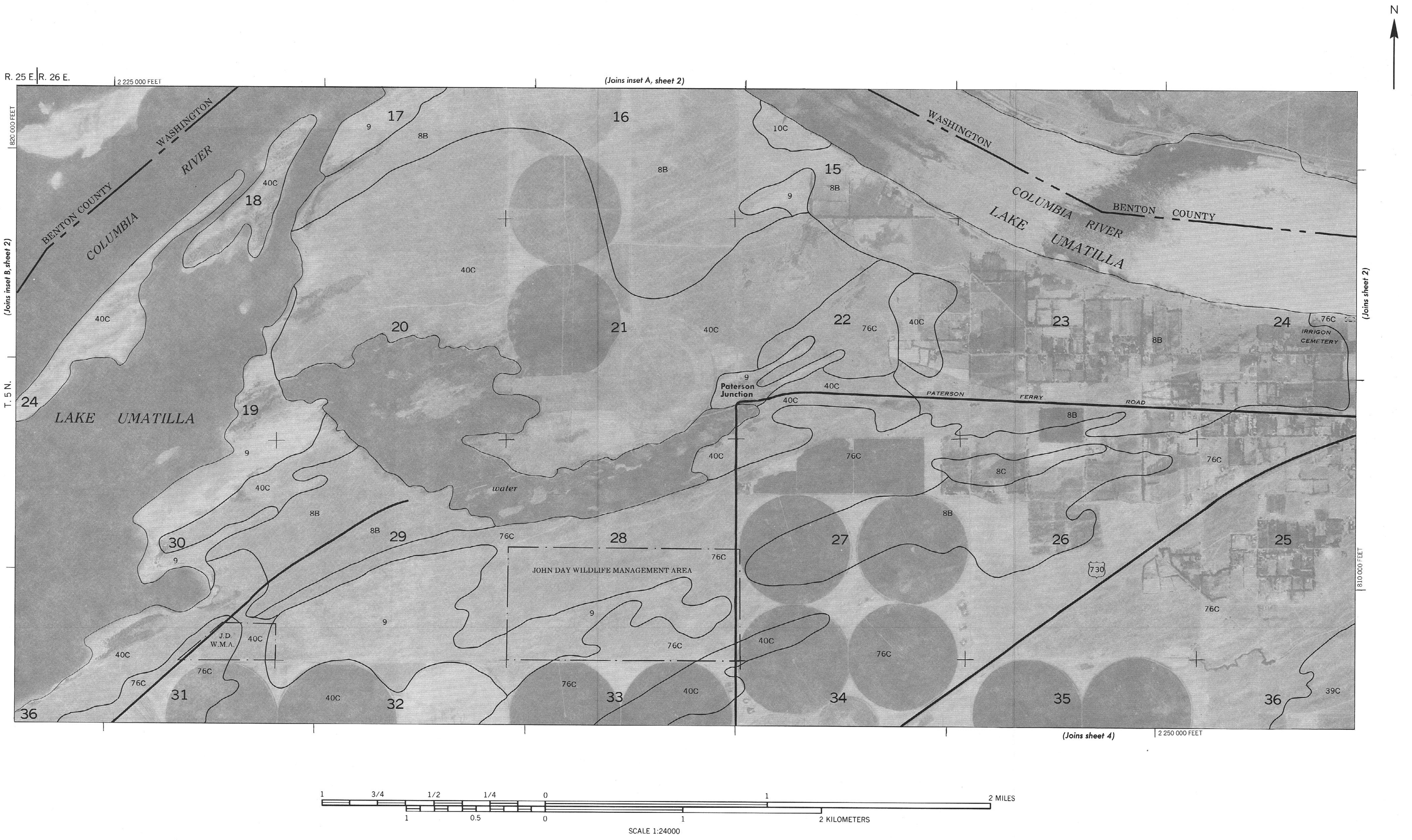
SOIL SAMPLE SITE (normally not shown) — Ⓢ

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot — +
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

MORROW COUNTY, OREGON — SHEET NUMBER 1

①


N
R. 25 E.
R. 26 E.
2 225 000 FEET
(Joins inset A, sheet 2)
(Joins inset B, sheet 2)
(Joins sheet 2)
(Joins sheet 4)
2 250 000 FEET
820 000 FEET
810 000 FEET
T. 5 N.
BENTON COUNTY
WASHINGTON
COLUMBIA RIVER
LAKE UMATILLA
IRRIGON CEMETERY
Paterson Junction
PATERSON FERRY ROAD
730
water
JOHN DAY WILDLIFE MANAGEMENT AREA
J.D. W.M.A.
15
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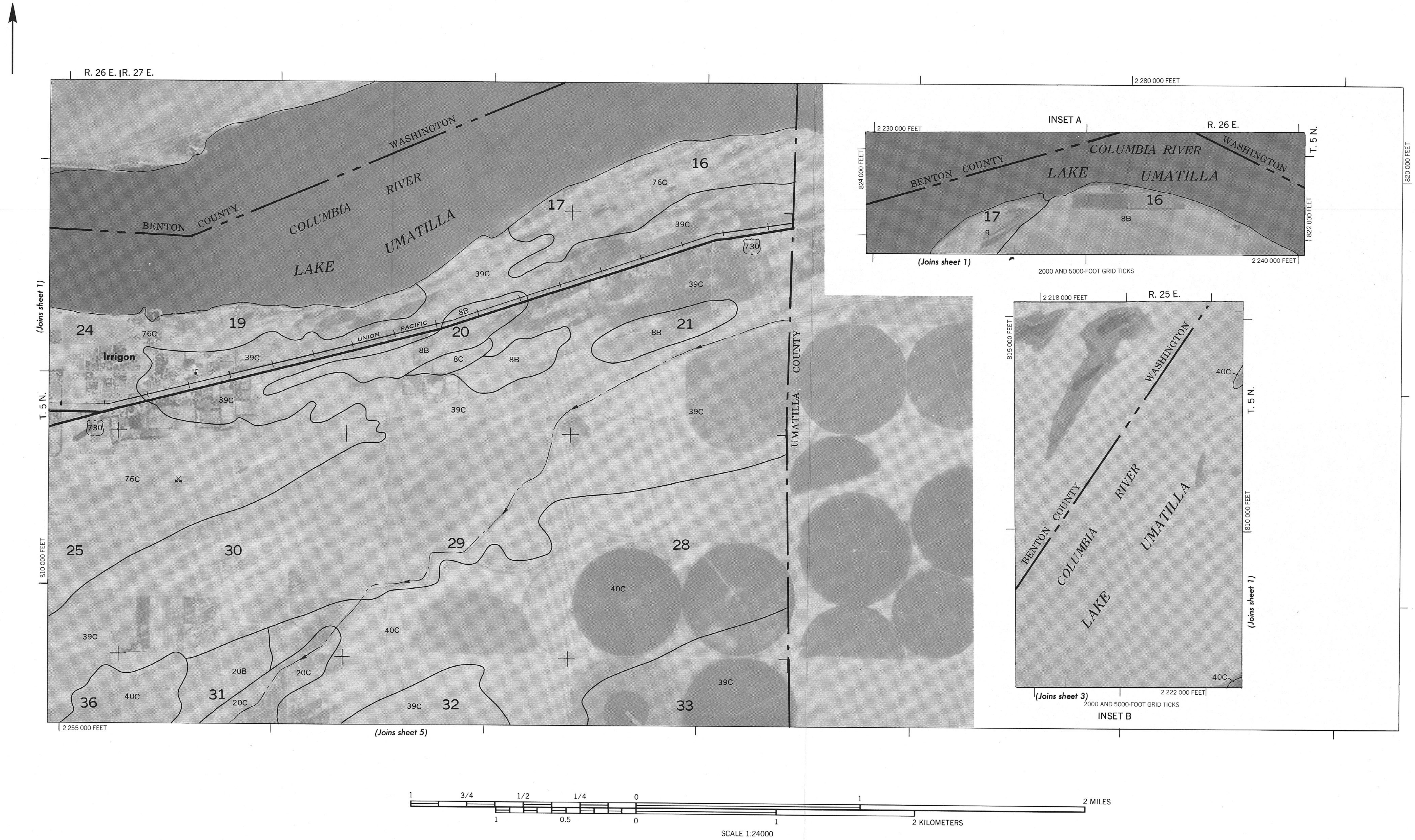
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON NO. 1

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

②

MORROW COUNTY, OREGON — SHEET NUMBER 2


N
R. 26 E. R. 27 E.
2 280 000 FEET
BENTON COUNTY
WASHINGTON
COLUMBIA RIVER
LAKE UMATILLA
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39C
24
76C
19
8B
UNION PACIFIC
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21
8B
Irrigon
39C
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8B
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39C
UMATILLA COUNTY
T. 5 N.
730
76C
(Joins sheet 1)
810 000 FEET
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39C
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20B
20C
36
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20C
39C
32
39C
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T. 5 N.
824 000 FEET
822 000 FEET
BENTON COUNTY
COLUMBIA RIVER
WASHINGTON
LAKE UMATILLA
17
9
16
8B
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2000 AND 5000-FOOT GRID TICKS
2 218 000 FEET
R. 25 E.
815 000 FEET
40C
T. 5 N.
WASHINGTON
BENTON COUNTY
COLUMBIA RIVER
LAKE UMATILLA
810 000 FEET
(Joins sheet 1)
40C
(Joins sheet 3)
2 222 000 FEET
2000 AND 5000-FOOT GRID TICKS
INSET B
820 000 FEET
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 2

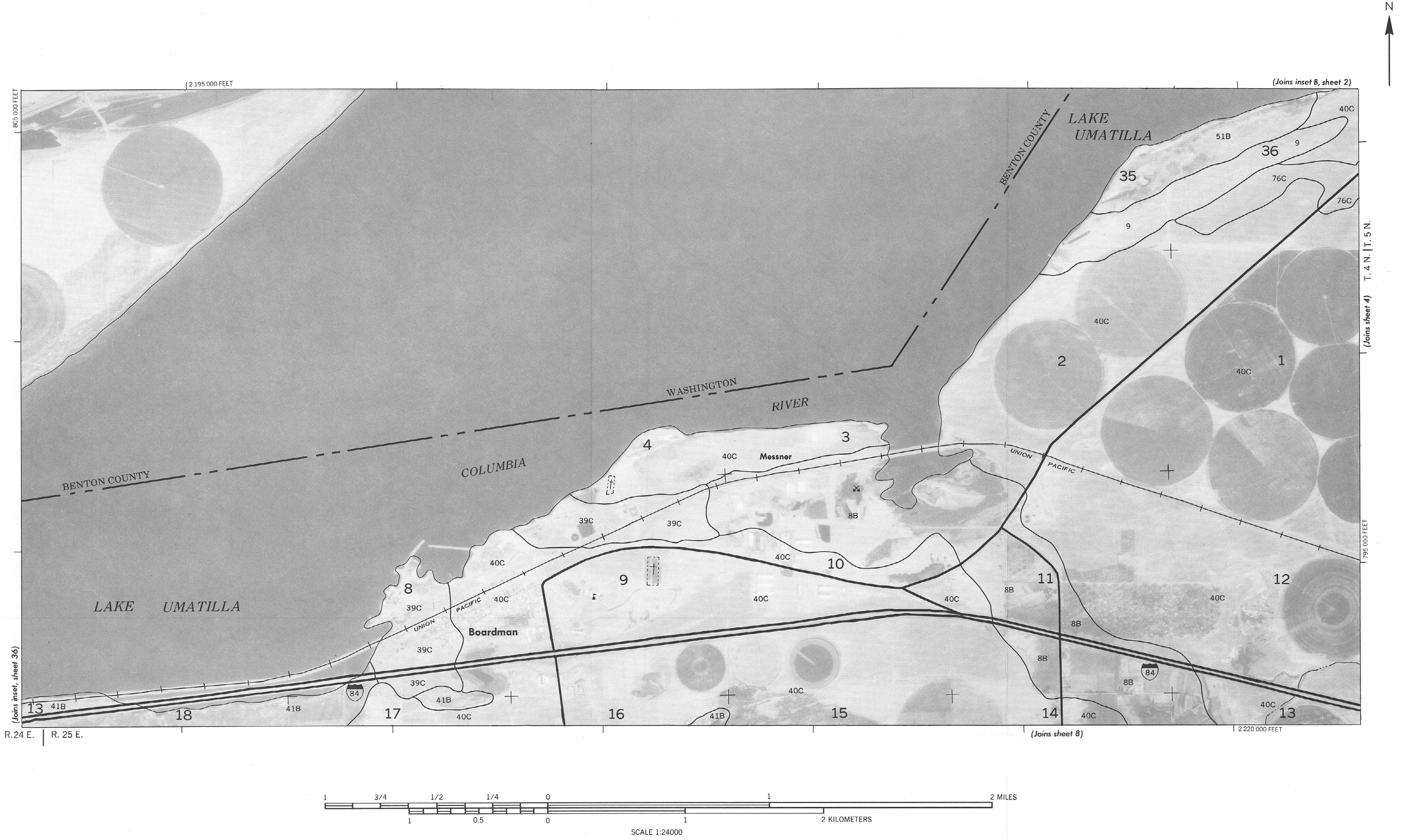
MORROW COUNTY, OREGON — SHEET NUMBER 3

MORROW COUNTY, OREGON NO. 3

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.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805 000 FEET
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LAKE UMATILLA
BENTON COUNTY
WASHINGTON
COLUMBIA
RIVER
BENTON COUNTY
LAKE UMATILLA
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51B
36
9
35
76C
76C
9
40C
2
1
40C
T. 4 N. | T. 5 N.
(Joins sheet 4)
795 000 FEET
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40C
Messner
UNION PACIFIC
8B
39C
39C
40C
10
11
12
8
9
40C
40C
39C
40C
40C
8B
40C
UNION PACIFIC
Boardman
8B
39C
8B
84
39C
84
8B
41B
40C
(Joins inset, sheet 36)
13
41B
18
41B
17
40C
16
41B
15
40C
14
40C
40C
13
2 220 000 FEET
R.24 E. | R. 25 E.
(Joins sheet 8)
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1/2
1/4
0
1
2 MILES
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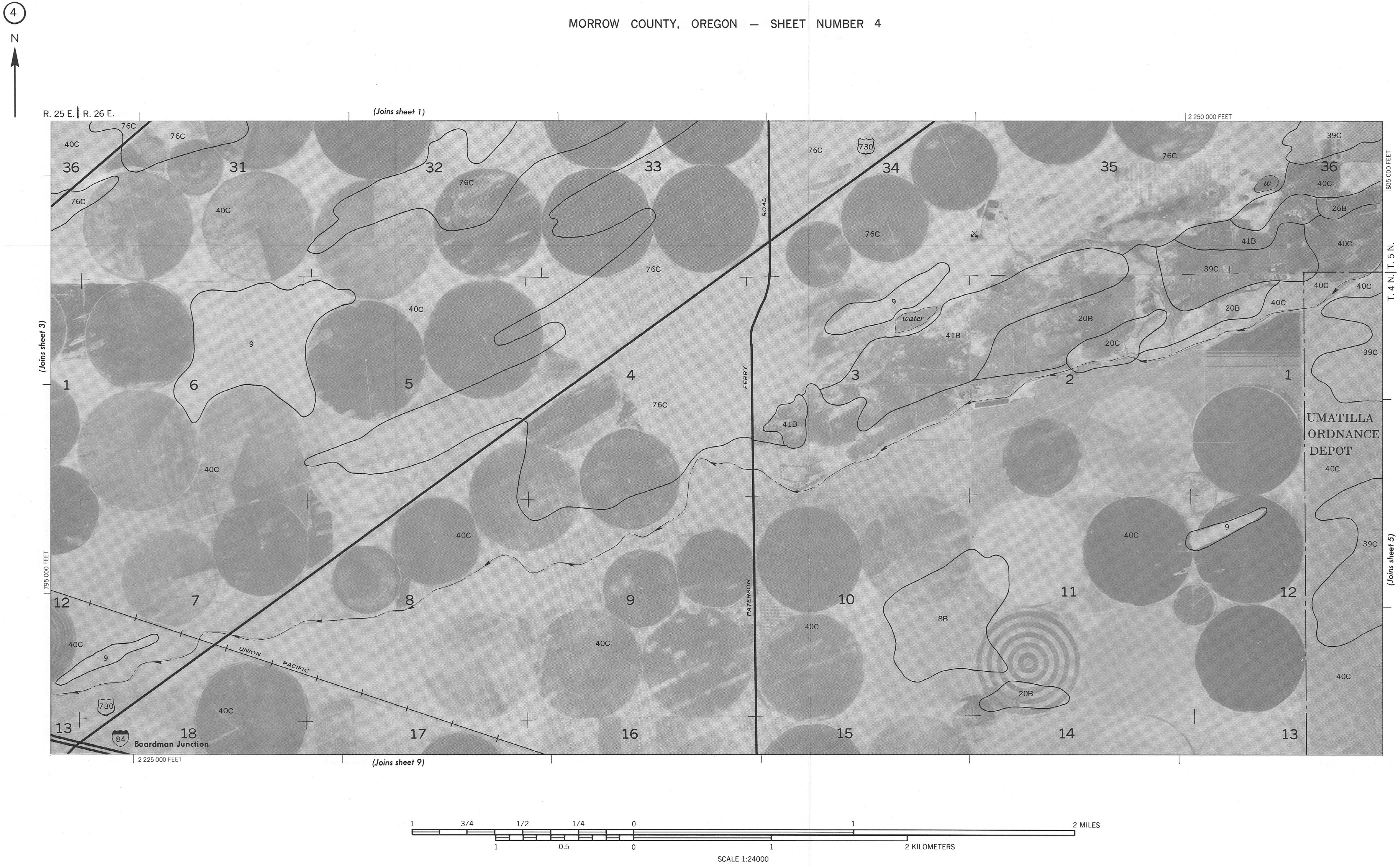
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 4


4
N
R. 25 E. | R. 26 E.
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 9)
2 250 000 FEET
805 000 FEET
795 000 FEET
2 225 000 FEET
T. 4 N. | T. 5 N.
36
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11
12
13
18
17
16
15
14
13
76C
40C
39C
26B
41B
20B
20C
9
8B
w
water
730
84
FERRY ROAD
PATERSON
UNION PACIFIC
Boardman Junction
UMATILLA ORDNANCE DEPOT
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

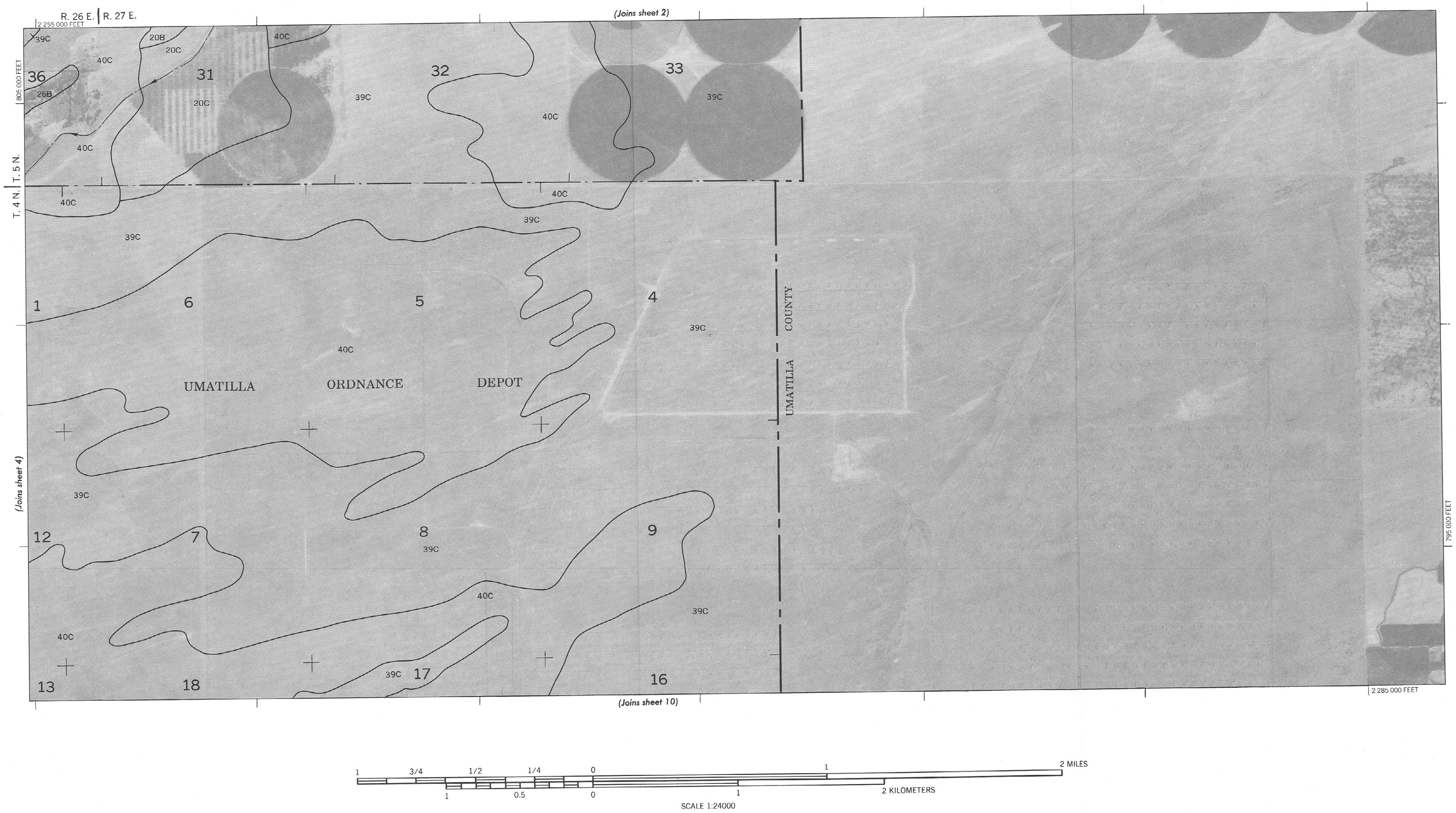
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 4

MORROW COUNTY, OREGON — SHEET NUMBER 5

MORROW COUNTY, OREGON NO. 5

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

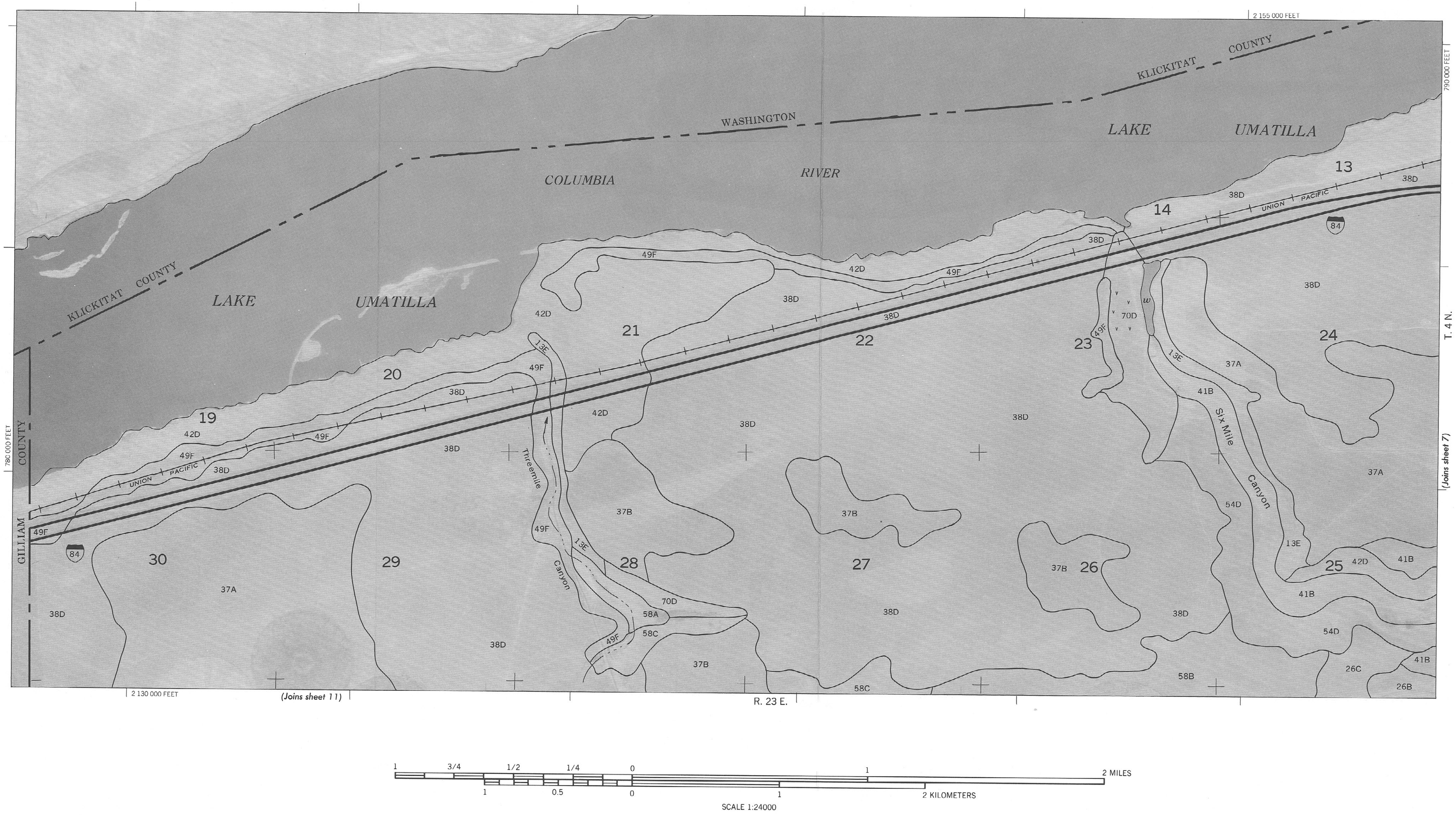

R. 26 E.
R. 27 E.
(Joins sheet 2)
2 255 000 FEET
805 000 FEET
T. 5 N.
T. 4 N.
39C
20B
20C
40C
36
26B
31
20C
32
39C
33
39C
40C
40C
40C
39C
39C
1
6
5
4
39C
40C
UMATILLA
ORDNANCE
DEPOT
UMATILLA COUNTY
(Joins sheet 4)
39C
12
7
8
39C
9
40C
39C
40C
39C
17
13
18
16
(Joins sheet 10)
795 000 FEET
2 285 000 FEET
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

N

⑥

N

MORROW COUNTY, OREGON — SHEET NUMBER 6

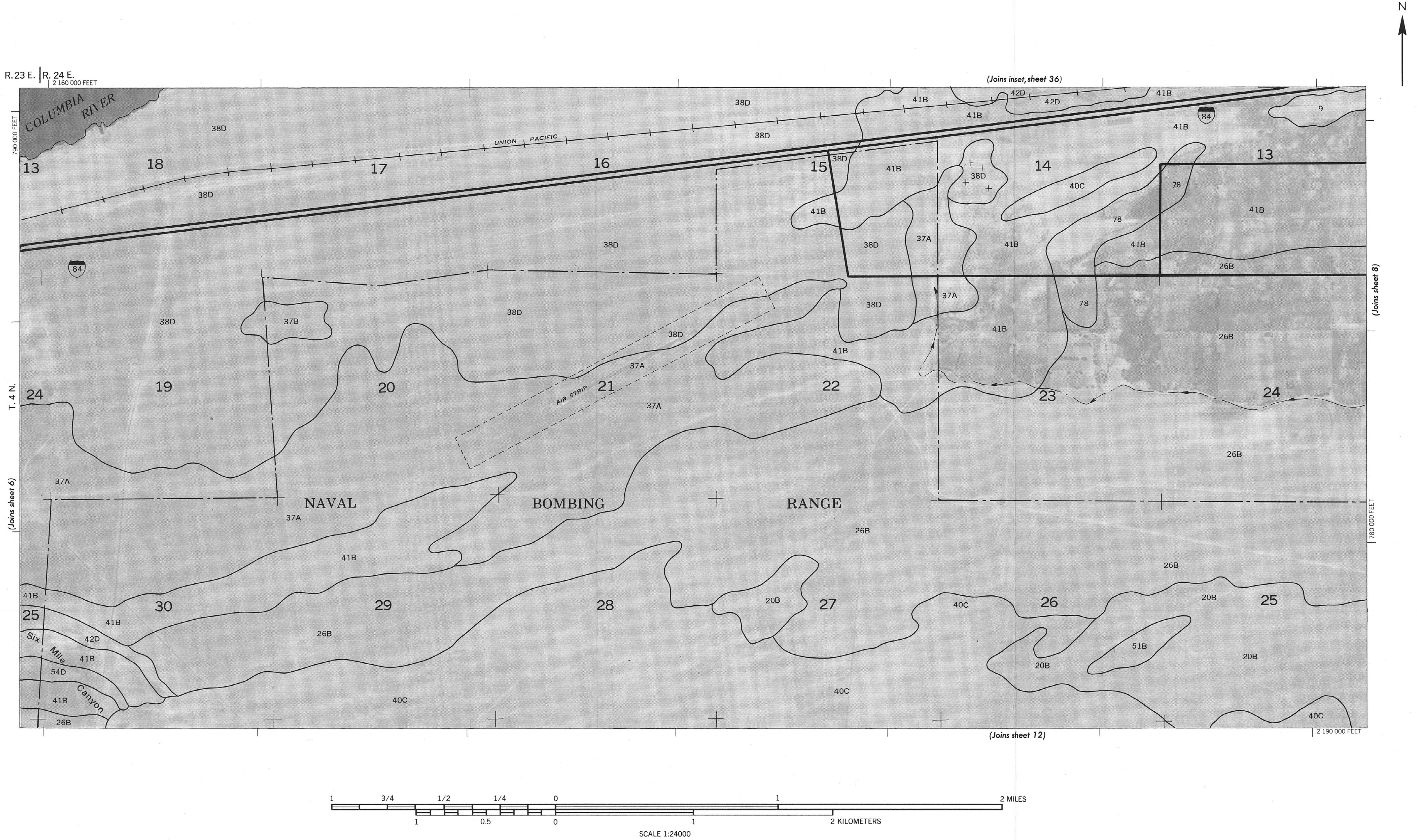

2 155 000 FEET
790 000 FEET
78C 000 FEET
2 130 000 FEET
(Joins sheet 11)
(Joins sheet 7)
R. 23 E.
T. 4 N.
KLICKITAT COUNTY
WASHINGTON
COLUMBIA RIVER
LAKE UMATILLA
GILLIAM COUNTY
UNION PACIFIC
84
Threemile Canyon
Six Mile Canyon
13
14
19
20
21
22
23
24
25
26
27
28
29
30
13E
26B
26C
37A
37B
38D
41B
42D
49F
54D
58A
58B
58C
70D
w
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 6

⑦

MORROW COUNTY, OREGON — SHEET NUMBER 7


N
R. 23 E.
R. 24 E.
2 160 000 FEET
(Joins inset, sheet 36)
790 000 FEET
COLUMBIA RIVER
UNION PACIFIC
84
38D
41B
42D
9
13
18
17
16
15
14
38D
41B
40C
78
37A
26B
T. 4 N.
24
19
20
21
22
23
37B
AIR STRIP
37A
(Joins sheet 6)
(Joins sheet 8)
NAVAL
BOMBING
RANGE
780 000 FEET
41B
25
30
29
28
27
26
20B
40C
51B
Six Mile Canyon
54D
26B
(Joins sheet 12)
2 190 000 FEET
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON NO. 7

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
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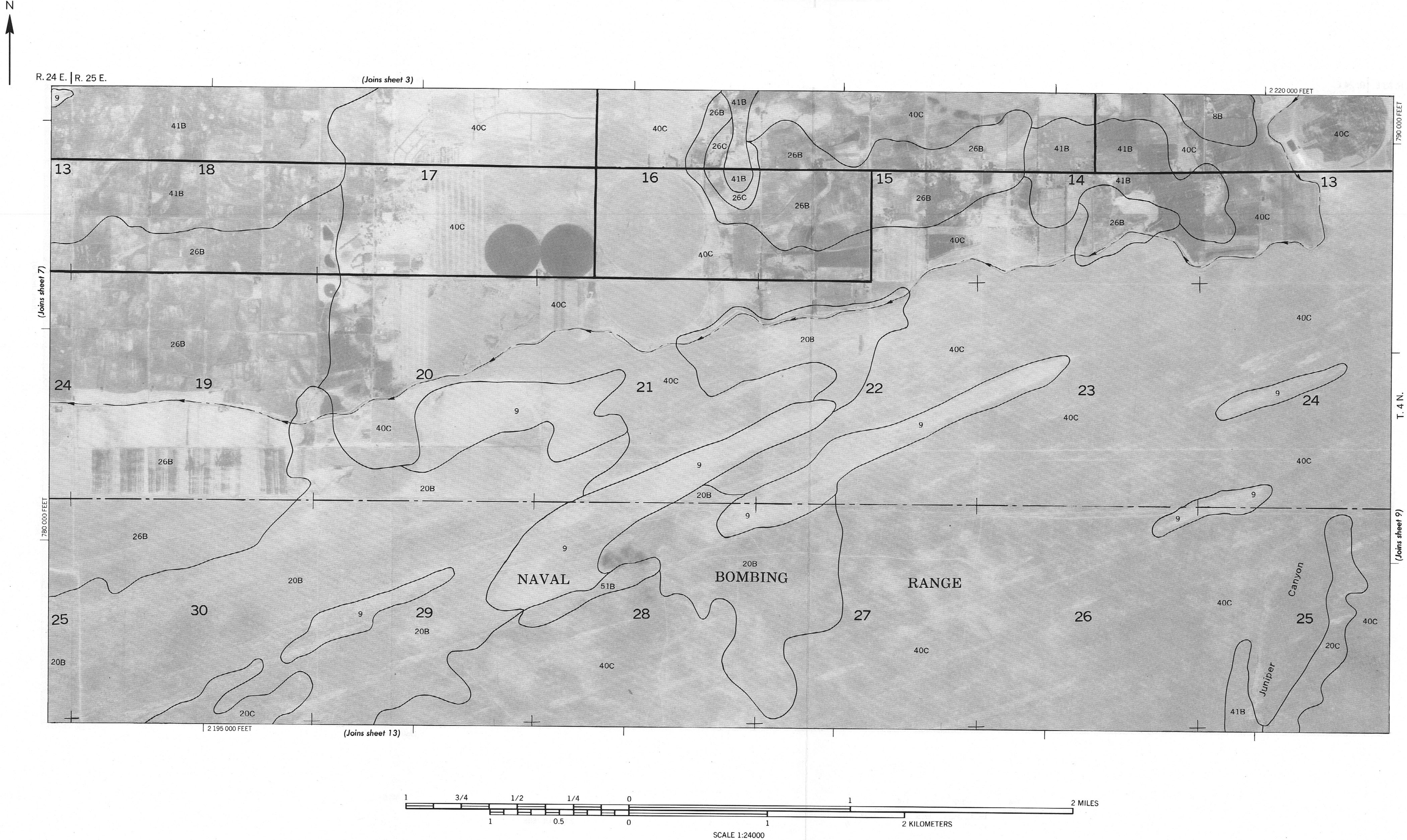
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

⑧

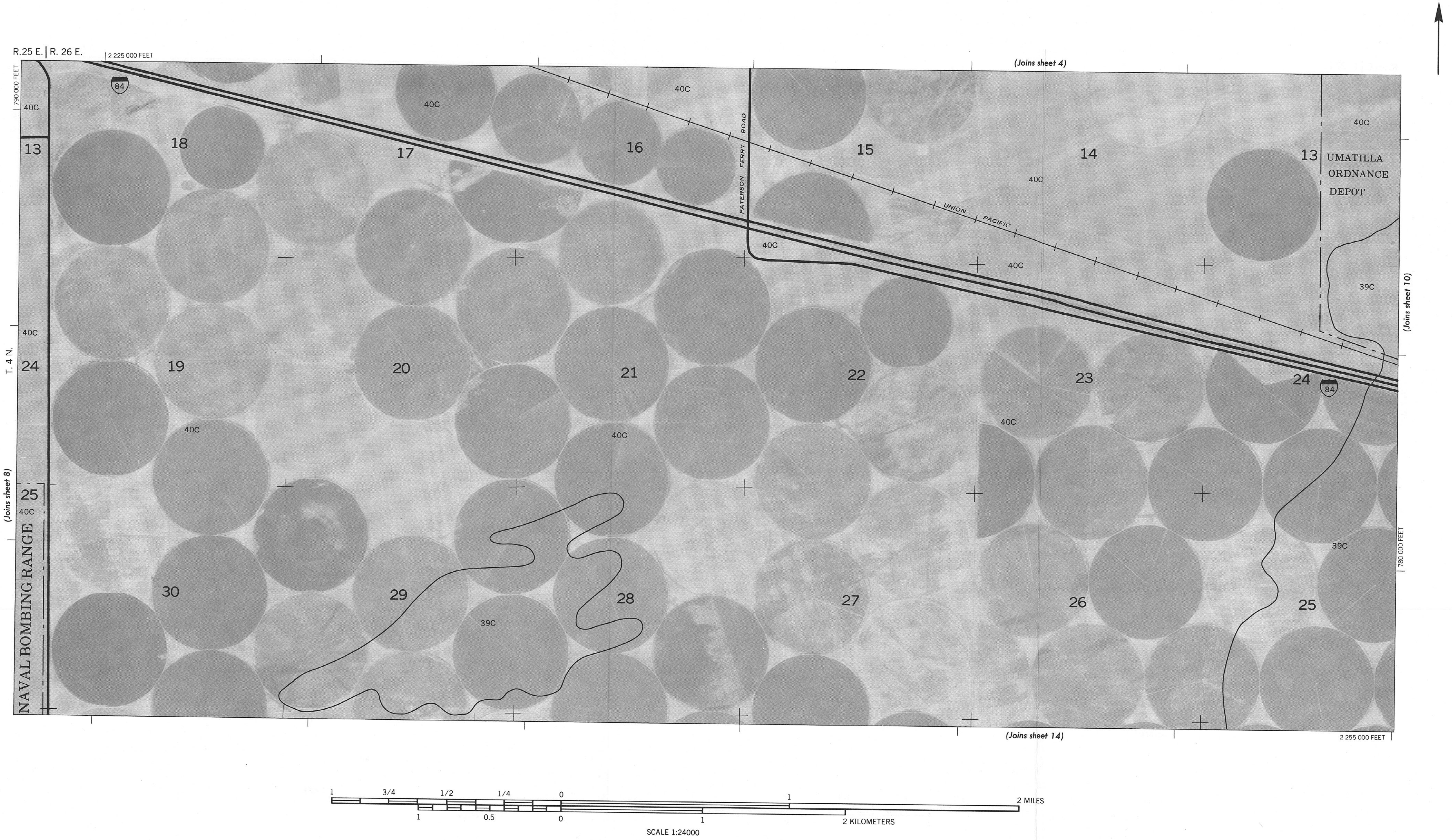
MORROW COUNTY, OREGON — SHEET NUMBER 8


N
R. 24 E.
R. 25 E.
(Joins sheet 3)
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 13)
2 220 000 FEET
790 000 FEET
780 000 FEET
2 195 000 FEET
T. 4 N.
13
18
17
16
15
14
13
24
19
20
21
22
23
24
25
30
29
28
27
26
25
9
41B
40C
26B
26C
41B
26C
8B
20B
20C
51B
NAVAL
BOMBING
RANGE
Juniper
Canyon
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 8

MORROW COUNTY, OREGON — SHEET NUMBER 9


N
R.25 E.
R. 26 E.
2 225 000 FEET
790 000 FEET
(Joins sheet 4)
84
40C
13
18
17
16
15
14
13
PATERSON FERRY ROAD
UNION PACIFIC
UMATILLA ORDNANCE DEPOT
39C
(Joins sheet 10)
T. 4 N.
24
19
20
21
22
23
24
25
(Joins sheet 8)
NAVAL BOMBING RANGE
30
29
28
27
26
25
39C
780 000 FEET
(Joins sheet 14)
2 255 000 FEET
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON NO. 9

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
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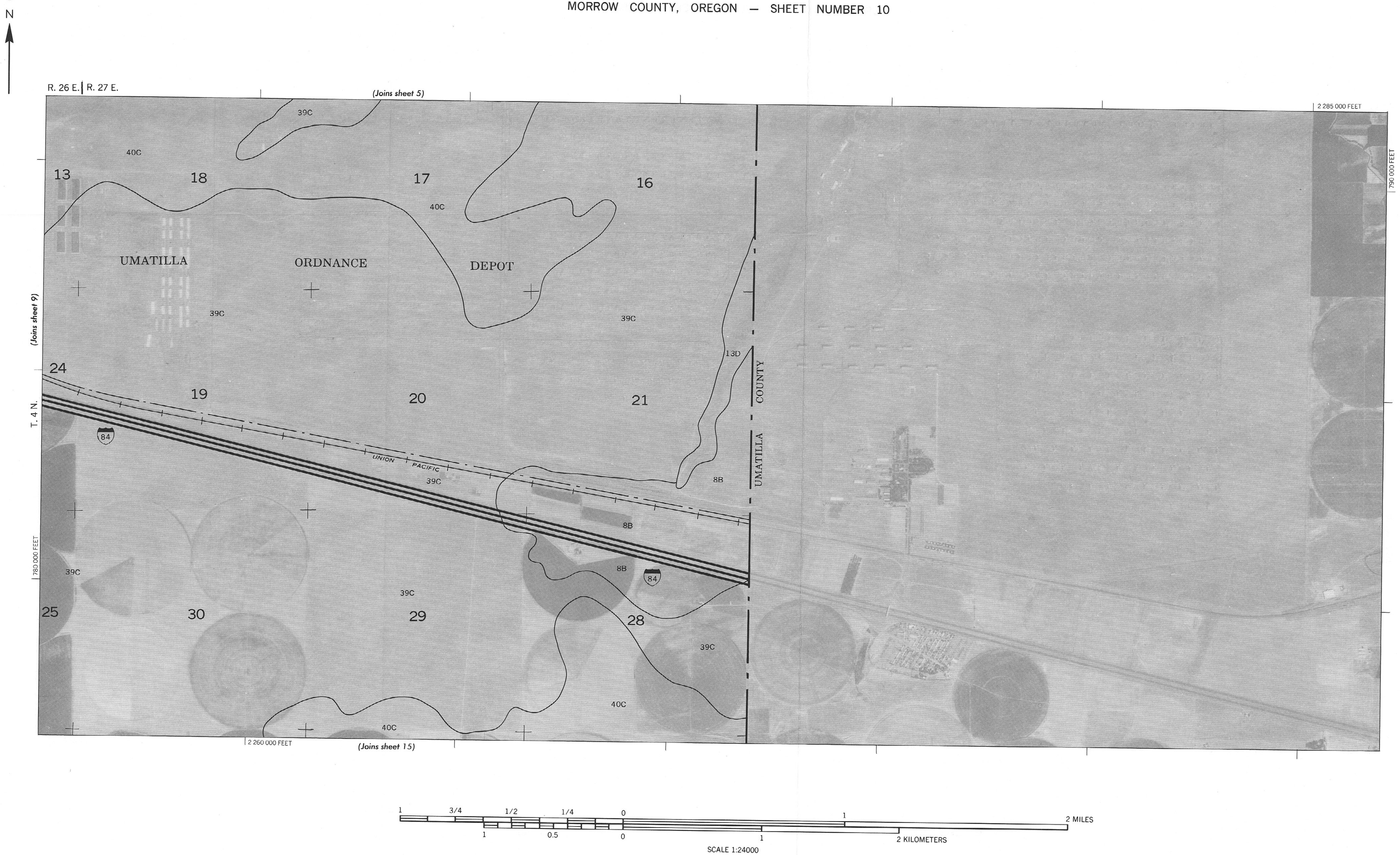
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MORROW COUNTY, OREGON — SHEET NUMBER 10


N
R. 26 E.
R. 27 E.
(Joins sheet 5)
2 285 000 FEET
790 000 FEET
(Joins sheet 9)
T. 4 N.
780 000 FEET
2 260 000 FEET
(Joins sheet 15)
13
18
17
16
24
19
20
21
25
30
29
28
UMATILLA
ORDNANCE
DEPOT
UMATILLA
COUNTY
UNION
PACIFIC
84
84
39C
40C
40C
39C
39C
13D
39C
8B
8B
8B
39C
39C
39C
40C
40C
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

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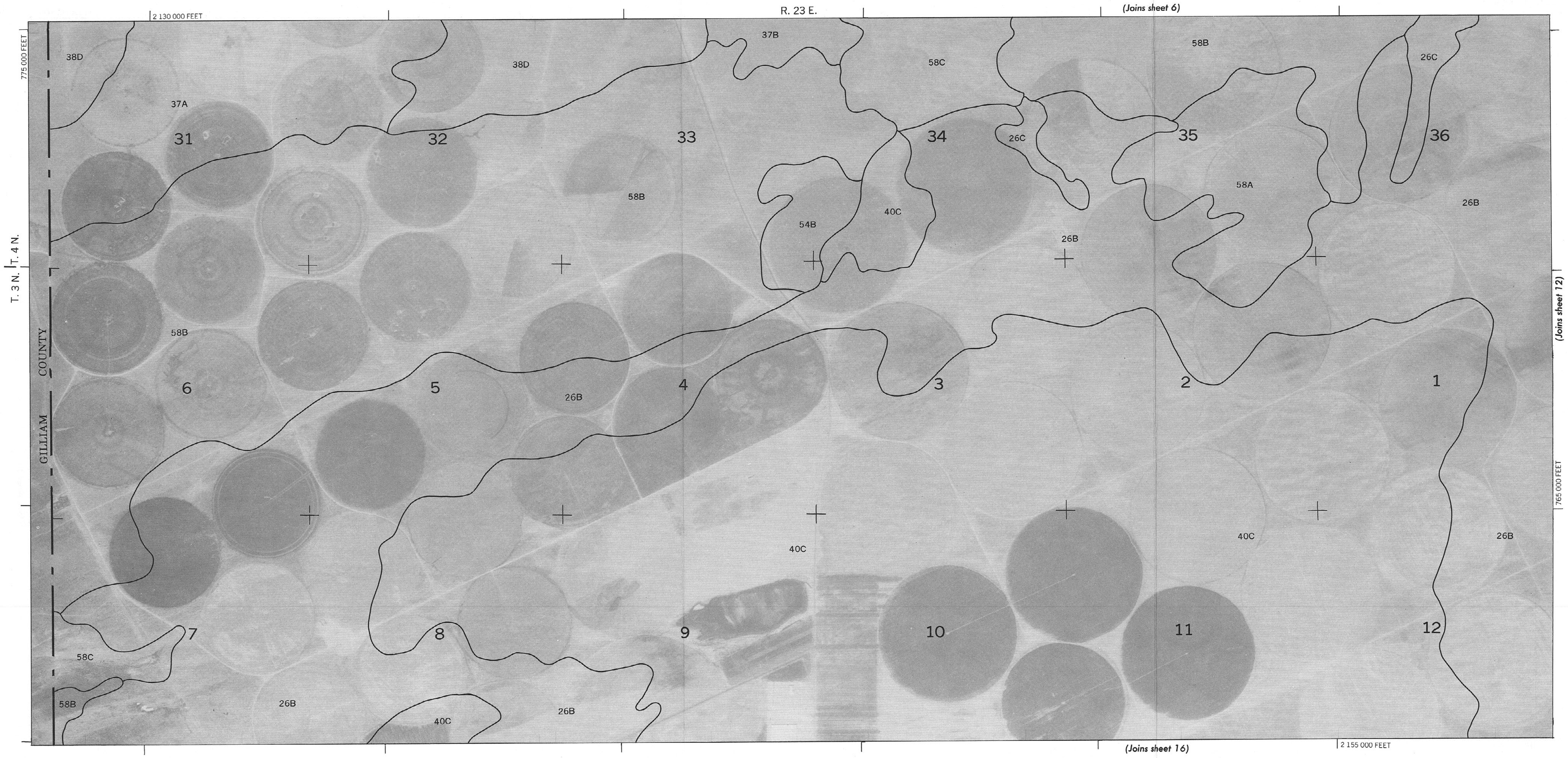
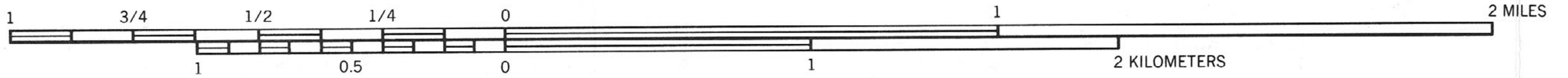
MORROW COUNTY, OREGON NO. 10

MORROW COUNTY, OREGON — SHEET NUMBER 11

MORROW COUNTY, OREGON NO. 11

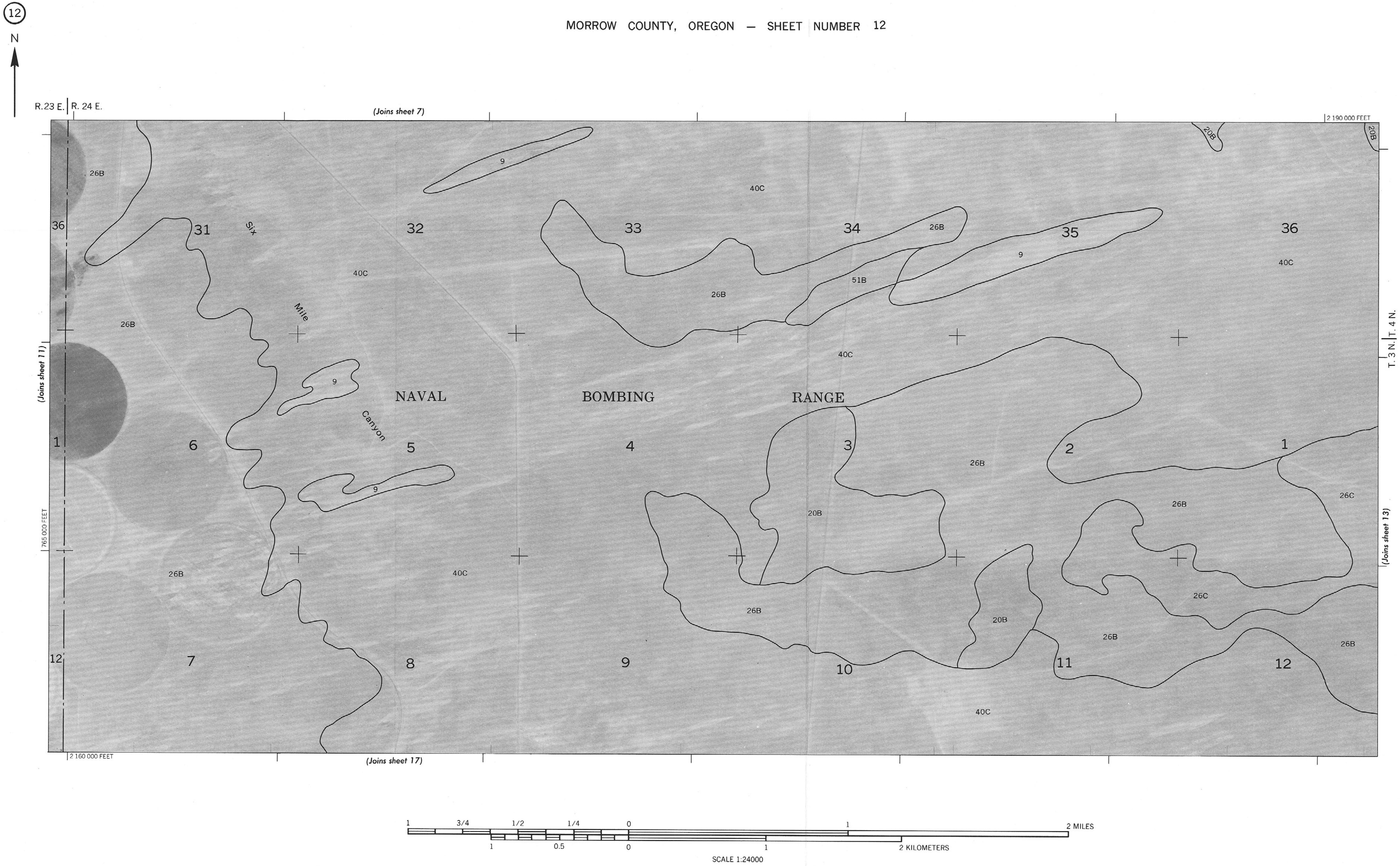
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


2 130 000 FEET
R. 23 E.
(Joins sheet 6)
775 000 FEET
T. 3 N.
T. 4 N.
GILLIAM
COUNTY
(Joins sheet 12)
765 000 FEET
(Joins sheet 16)
2 155 000 FEET
38D
37A
38D
37B
58C
58B
26C
31
32
33
34
26C
35
36
58B
54B
40C
58A
26B
26B
58B
6
5
26B
4
3
2
1
40C
40C
26B
7
8
9
10
11
12
58C
58B
26B
40C
26B


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 12



12
N
R.23 E.
R. 24 E.
(Joins sheet 7)
2 190 000 FEET
(Joins sheet 11)
765 000 FEET
(Joins sheet 13)
T. 3 N.
T. 4 N.
2 160 000 FEET
(Joins sheet 17)
NAVAL
BOMBING
RANGE
Six
Mile
Canyon
36
31
32
33
34
35
36
1
6
5
4
3
2
1
12
7
8
9
10
11
12
26B
9
40C
20B
26B
51B
26C
26B
40C
20B
26B
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

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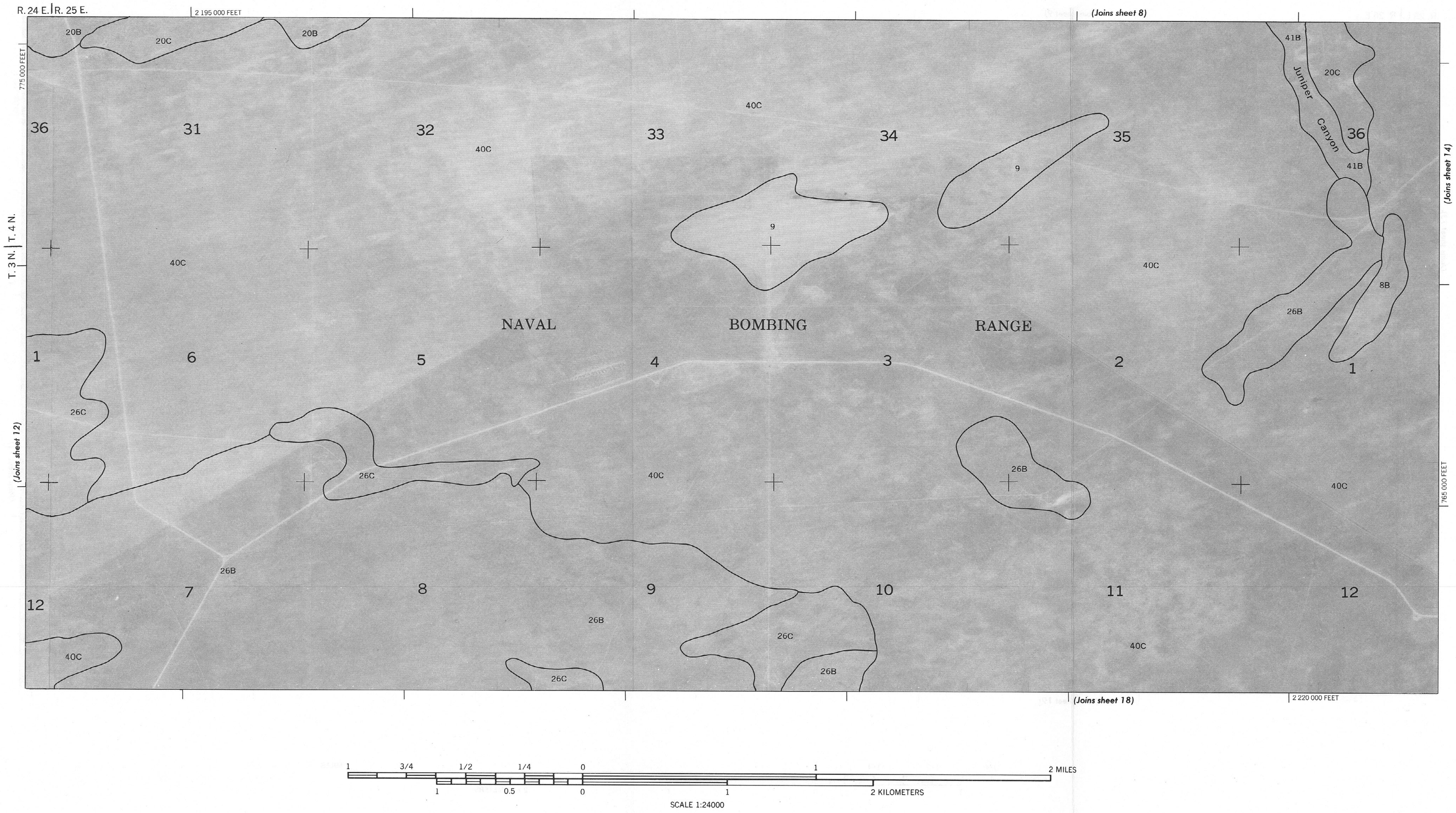
MORROW COUNTY, OREGON NO. 12

MORROW COUNTY, OREGON — SHEET NUMBER 13

N


R. 24 E. | R. 25 E.
2 195 000 FEET
(Joins sheet 8)
775 000 FEET
T. 3 N. | T. 4 N.
(Joins sheet 12)
(Joins sheet 14)
765 000 FEET
(Joins sheet 18)
2 220 000 FEET
20B
20C
20B
41B
20C
Juniper Canyon
40C
36
31
32
33
34
35
36
40C
9
41B
9
40C
40C
8B
26B
NAVAL
BOMBING
RANGE
1
6
5
4
3
2
1
26C
26C
40C
26B
40C
26B
12
7
8
9
10
11
12
26B
40C
26C
26B
40C
26C
26B
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON NO. 13

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
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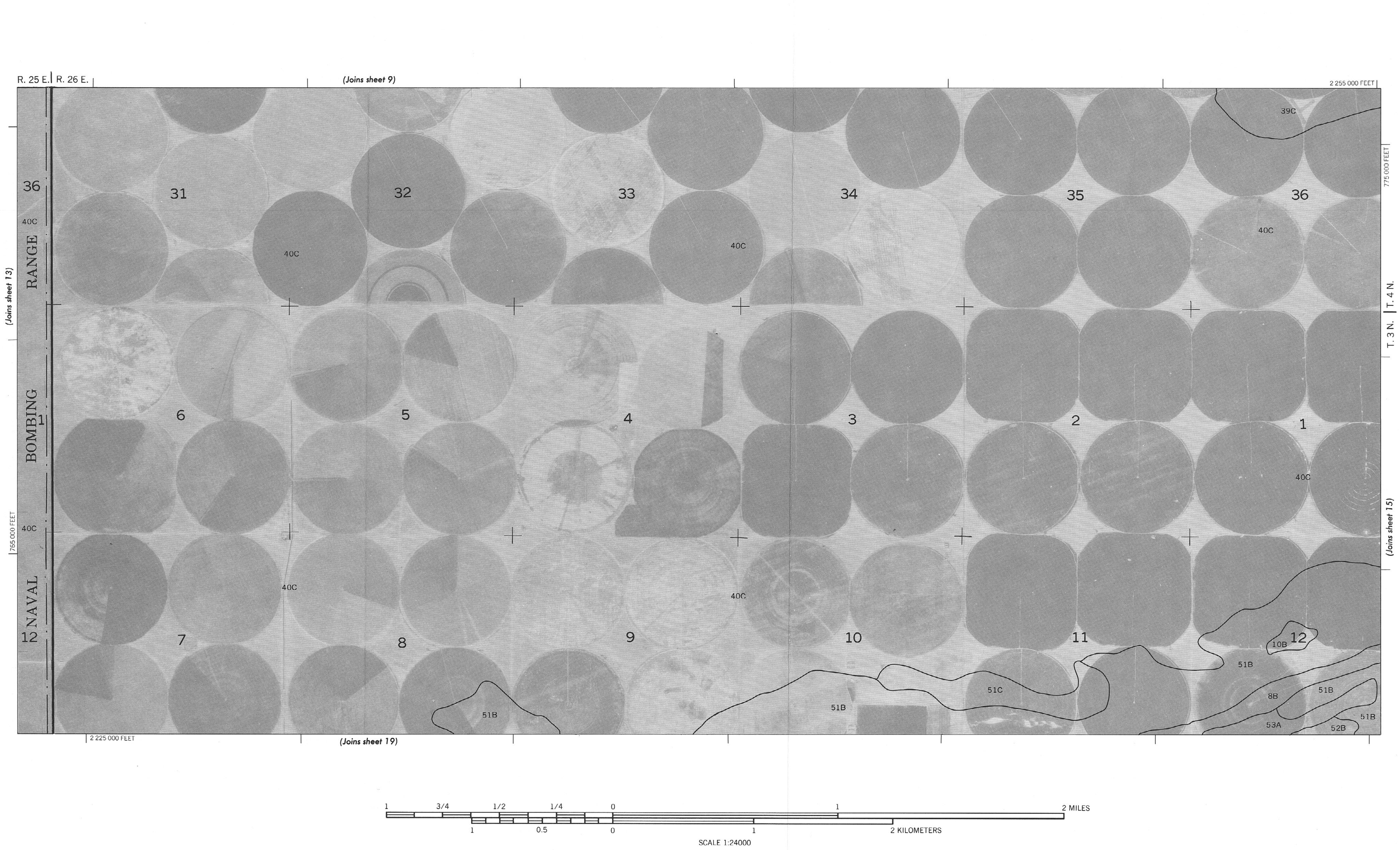
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MORROW COUNTY, OREGON — SHEET NUMBER 14


N
R. 25 E.
R. 26 E.
(Joins sheet 9)
2 255 000 FEET
775 000 FEET
T. 4 N.
T. 3 N.
(Joins sheet 15)
(Joins sheet 13)
765 000 FEET
2 225 000 FEET
(Joins sheet 19)
RANGE
BOMBING
NAVAL
36
31
32
33
34
35
36
1
6
5
4
3
2
1
12
7
8
9
10
11
12
39C
40C
40C
40C
40C
40C
40C
40C
40C
40C
51B
51B
51C
51B
10B
8B
51B
51B
53A
52B
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

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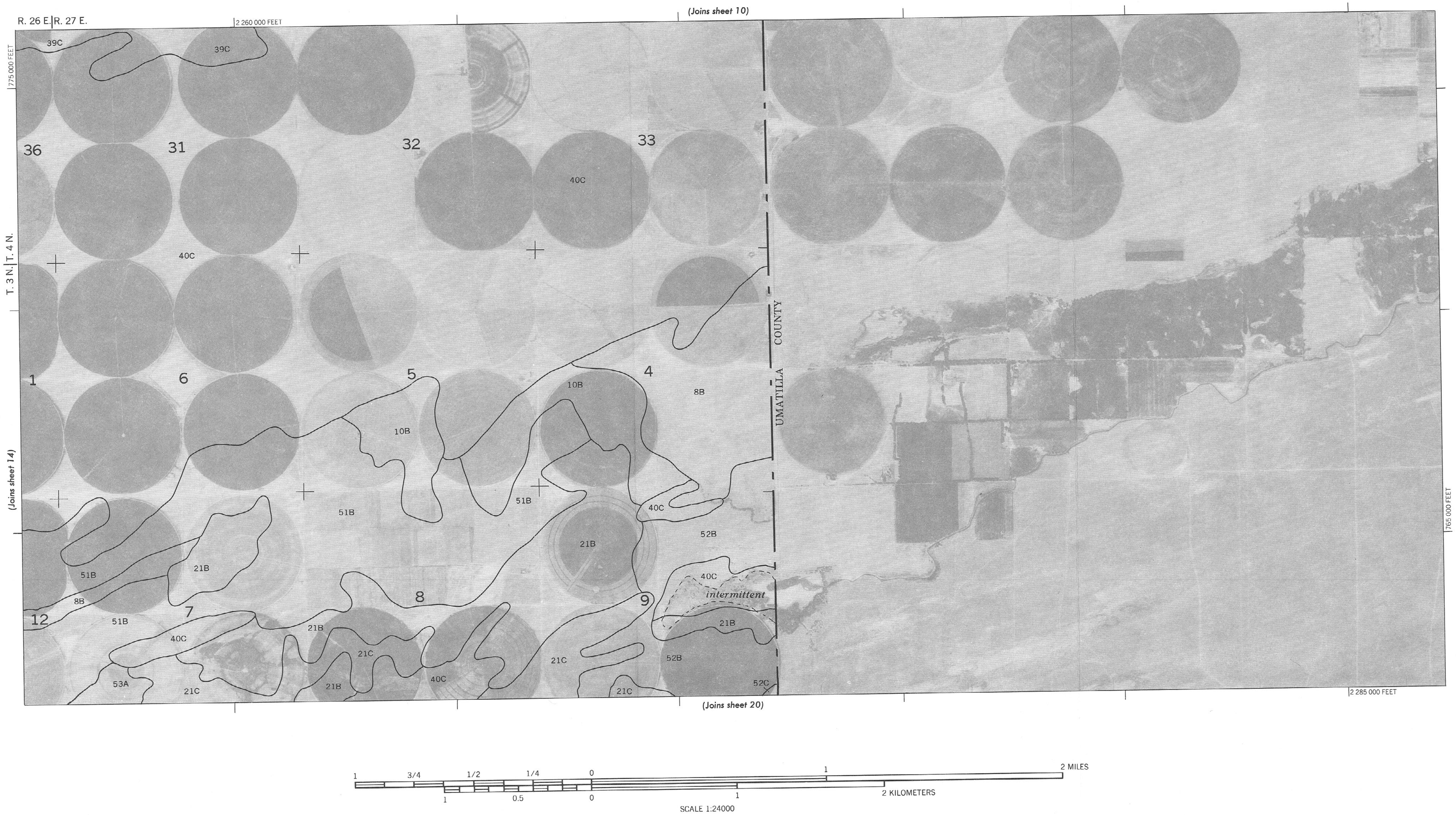
MORROW COUNTY, OREGON NO. 14

MORROW COUNTY, OREGON — SHEET NUMBER 15


N
(Joins sheet 10)
R. 26 E. | R. 27 E.
2 260 000 FEET
775 000 FEET
T. 4 N.
T. 3 N.
(Joins sheet 14)
(Joins sheet 20)
765 000 FEET
2 285 000 FEET
UMATILLA COUNTY
36
31
32
33
1
6
5
4
12
7
8
9
39C
39C
40C
40C
10B
10B
8B
51B
51B
51B
51B
21B
21B
21B
21B
21B
40C
40C
40C
40C
52B
52B
52C
8B
21C
21C
21C
21C
53A
intermittent
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON NO. 15

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
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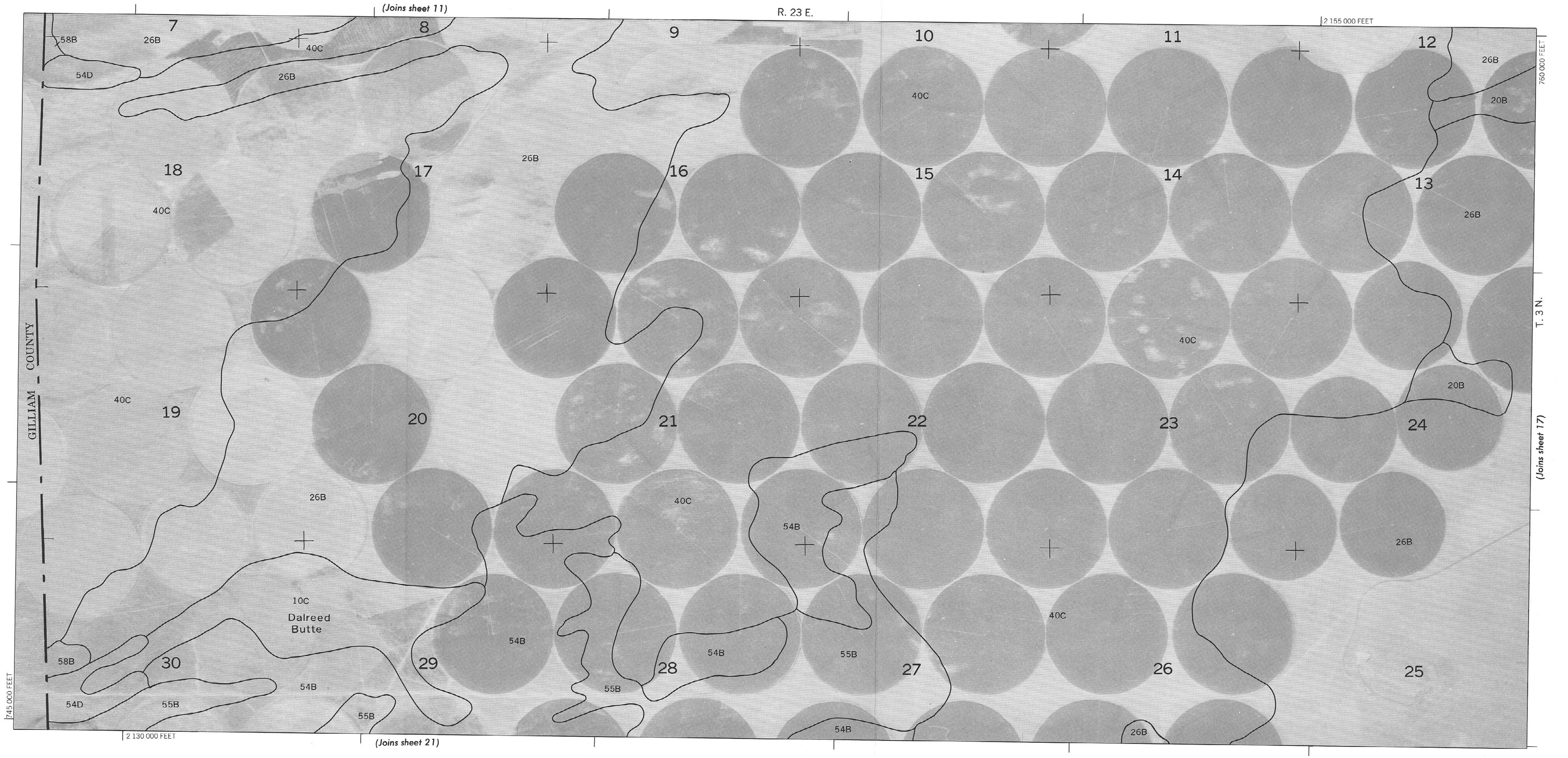
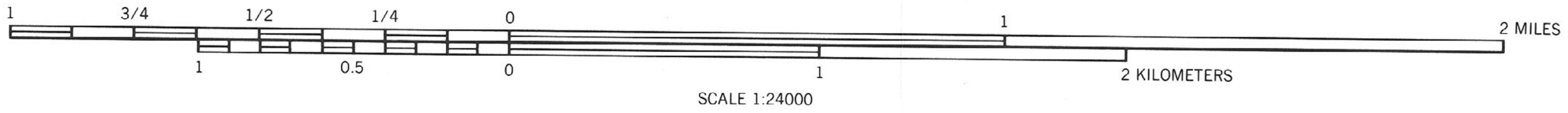
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

16

MORROW COUNTY, OREGON — SHEET NUMBER 16


(Joins sheet 11)
R. 23 E.
2 155 000 FEET
760 000 FEET
T. 3 N.
(Joins sheet 17)
(Joins sheet 21)
2 130 000 FEET
745 000 FEET
GILLIAM COUNTY
7
8
9
10
11
12
18
17
16
15
14
13
19
20
21
22
23
24
30
29
28
27
26
25
58B
26B
40C
54D
26B
26B
40C
40C
26B
20B
26B
40C
40C
40C
20B
26B
40C
54B
26B
10C
Dalreed Butte
58B
54D
55B
54B
55B
54B
55B
54B
55B
40C
54B
26B


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 16

MORROW COUNTY, OREGON — SHEET NUMBER 17

MORROW COUNTY, OREGON NO. 17

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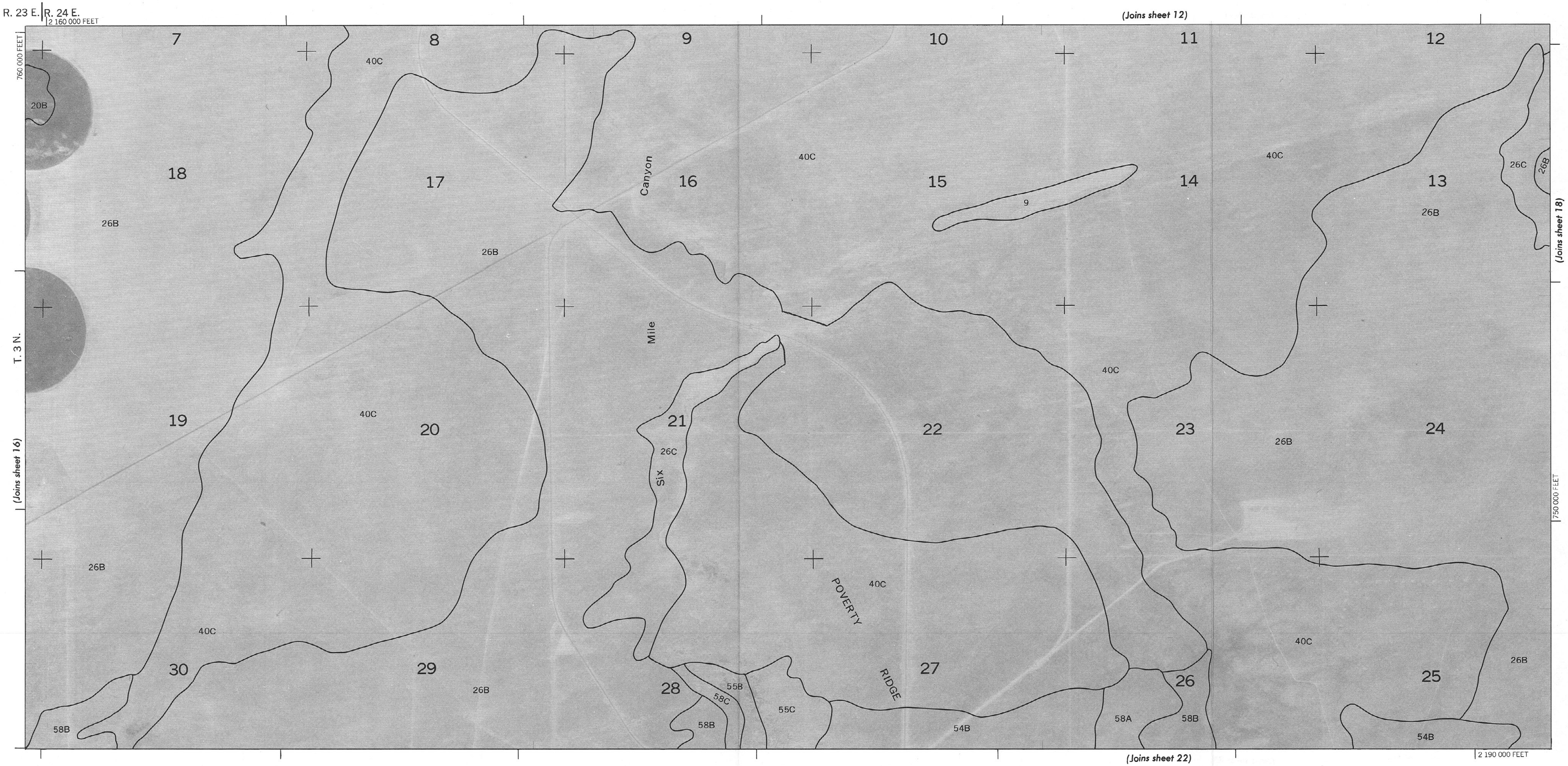
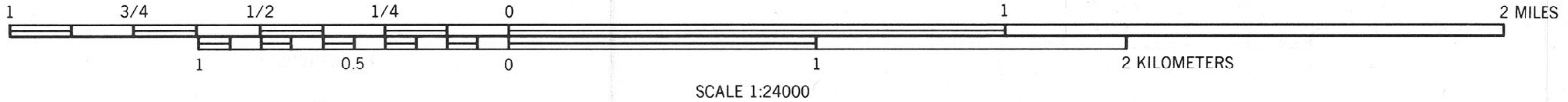
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

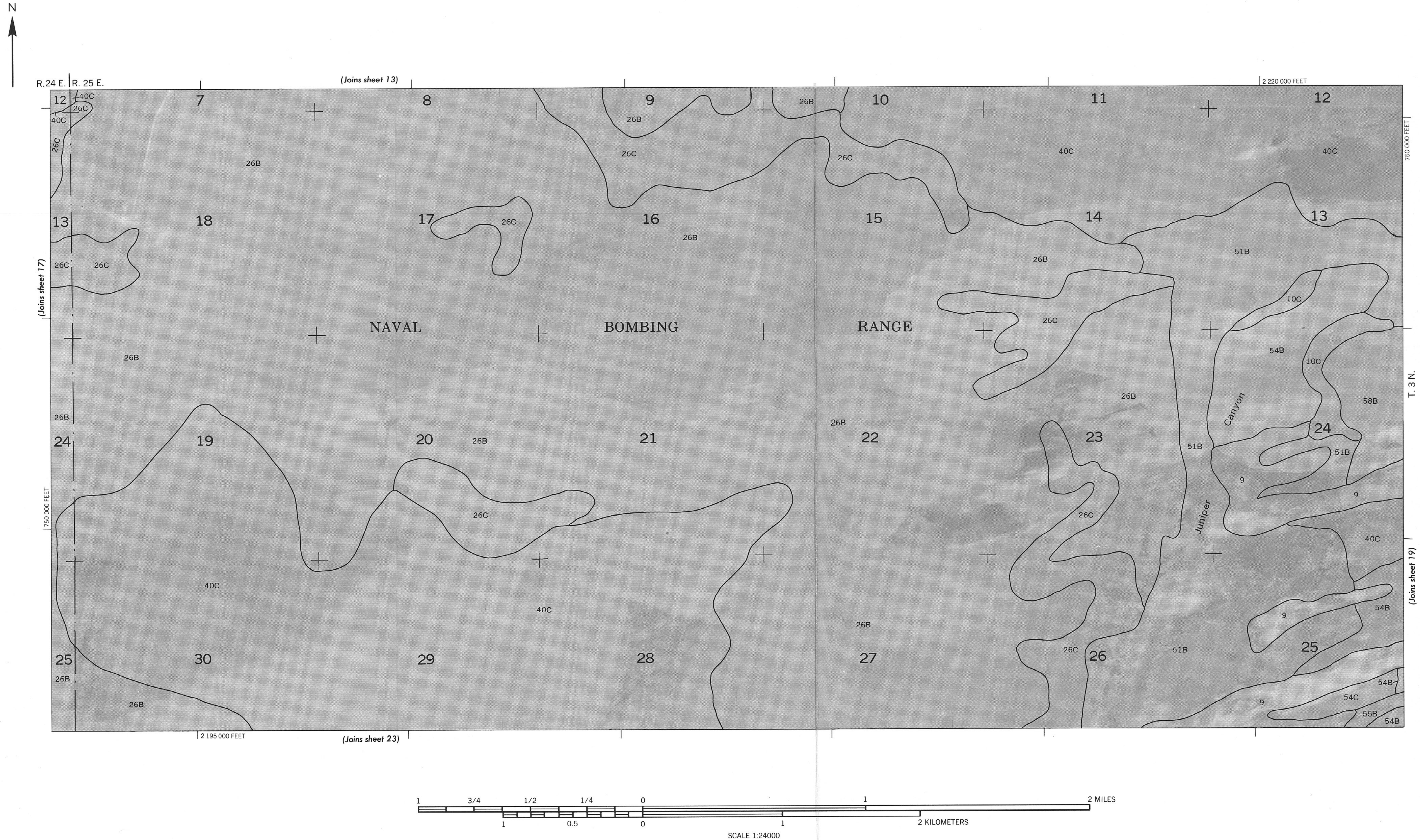

R. 23 E.
R. 24 E.
2 160 000 FEET
760 000 FEET
(Joins sheet 12)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 22)
750 000 FEET
2 190 000 FEET
T. 3 N.
7
8
9
10
11
12
18
17
16
15
14
13
19
20
21
22
23
24
30
29
28
27
26
25
20B
40C
26B
26C
9
55B
58C
55C
58B
54B
58A
Canyon
Mile
Six
POVERTY
RIDGE


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

(18)

MORROW COUNTY, OREGON — SHEET NUMBER 18


N
R.24 E.
R.25 E.
(Joins sheet 13)
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 23)
2 220 000 FEET
2 195 000 FEET
750 000 FEET
750 000 FEET
T. 3 N.
NAVAL
BOMBING
RANGE
Juniper
Canyon
12
7
8
9
10
11
12
13
18
17
16
15
14
13
24
19
20
21
22
23
24
25
30
29
28
27
26
25
26B
26C
40C
51B
54B
54C
55B
58B
10C
9
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

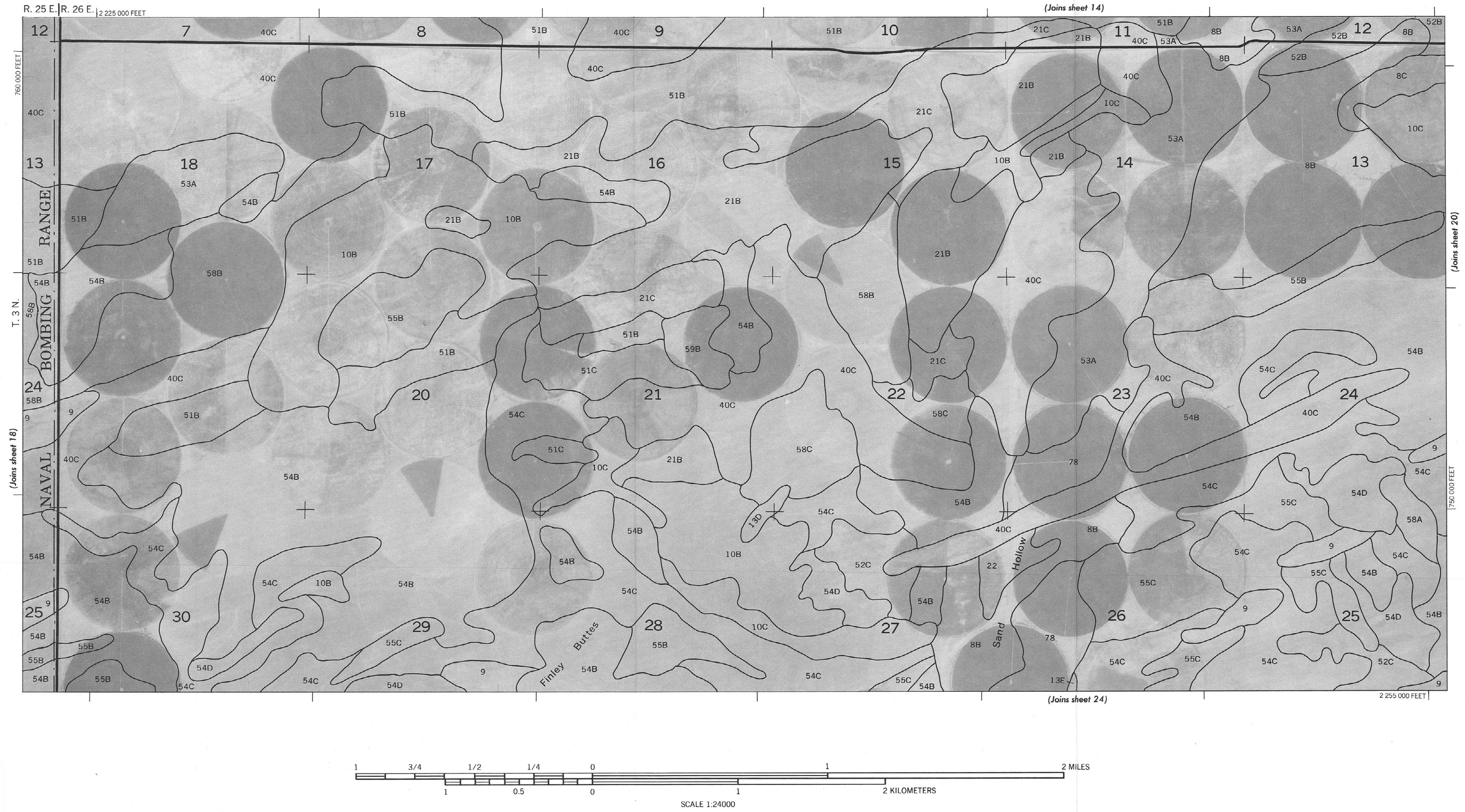
Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 18

MORROW COUNTY, OREGON — SHEET NUMBER 19

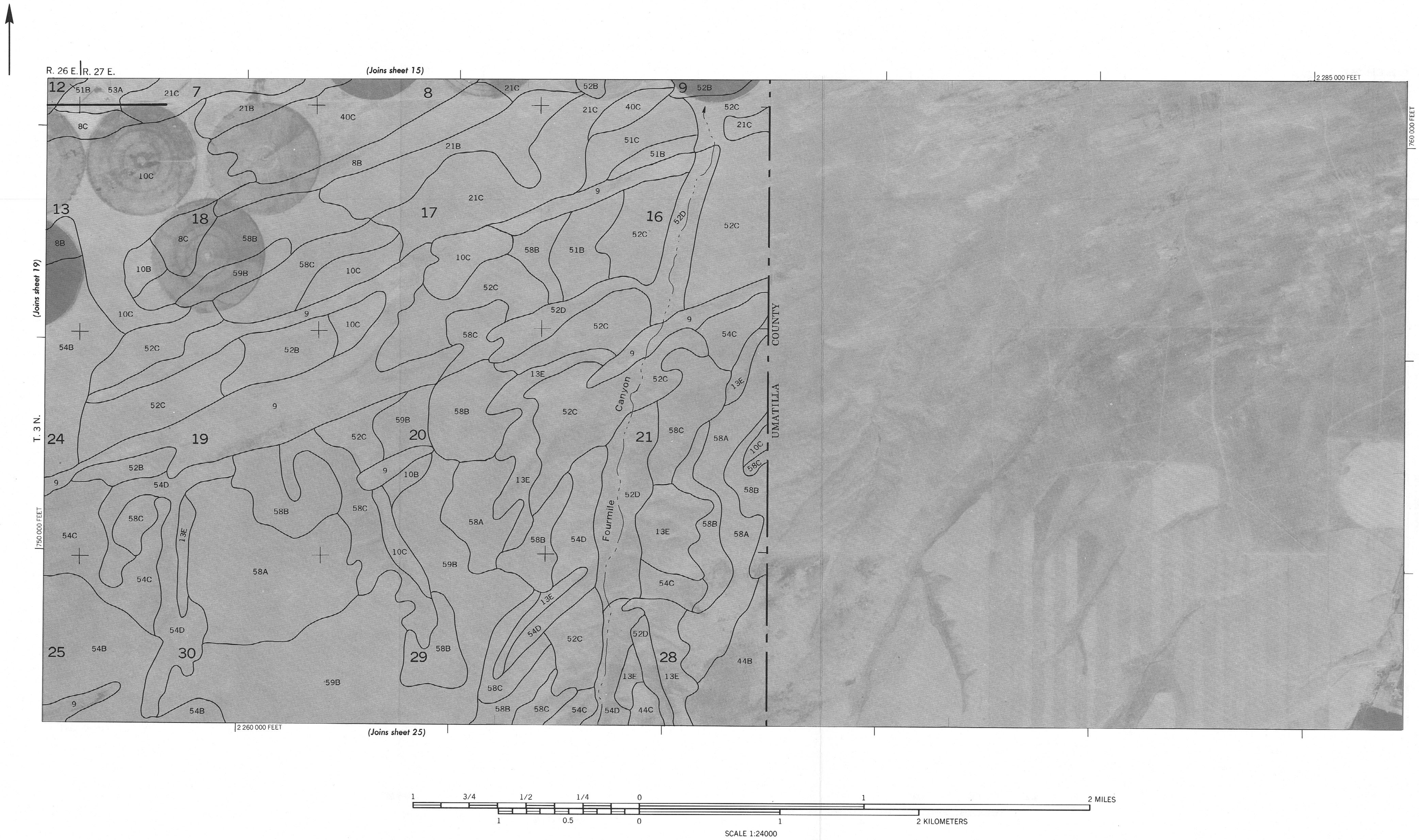
MORROW COUNTY, OREGON NO. 19

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


R. 25 E.
R. 26 E.
2 225 000 FEET
(Joins sheet 14)
760 000 FEET
T. 3 N.
(Joins sheet 18)
(Joins sheet 20)
750 000 FEET
(Joins sheet 24)
2 255 000 FEET
NAVAL BOMBING RANGE
Sand Hollow
Finley Buttes
12
7
8
9
10
11
12
13
18
17
16
15
14
13
24
20
21
22
23
24
25
30
29
28
27
26
25
40C
51B
21C
21B
53A
8B
52B
8C
10C
10B
54B
58B
55B
21C
59B
51C
54C
58C
10C
13D
52C
54D
55C
78
22
58A
9
13E
55B
8B
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

N

MORROW COUNTY, OREGON — SHEET NUMBER 20


N
R. 26 E.
R. 27 E.
(Joins sheet 15)
(Joins sheet 19)
(Joins sheet 25)
T. 3 N.
2 285 000 FEET
760 000 FEET
750 000 FEET
2 260 000 FEET
UMATILLA COUNTY
Fourmile
Canyon
12
7
8
9
13
18
17
16
24
19
20
21
25
30
29
28
51B
53A
21C
21B
8C
40C
10C
8B
21B
52B
21C
40C
51C
51B
52C
21C
9
52D
58B
59B
58C
10B
10C
52C
51B
52D
54C
54B
52B
13E
58A
58B
59B
10B
54D
44B
44C
13E
58C
54C
9
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

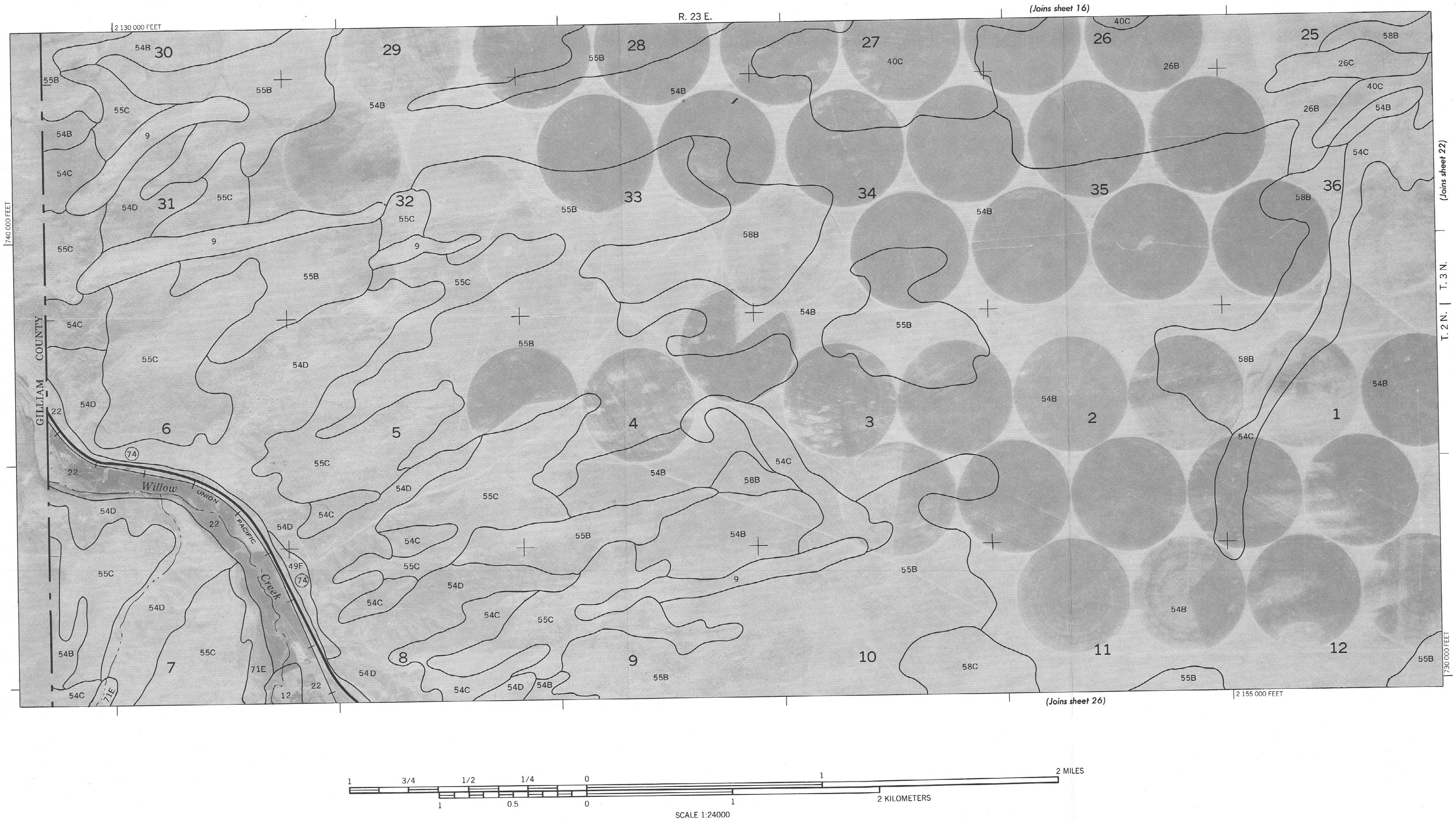
Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 20

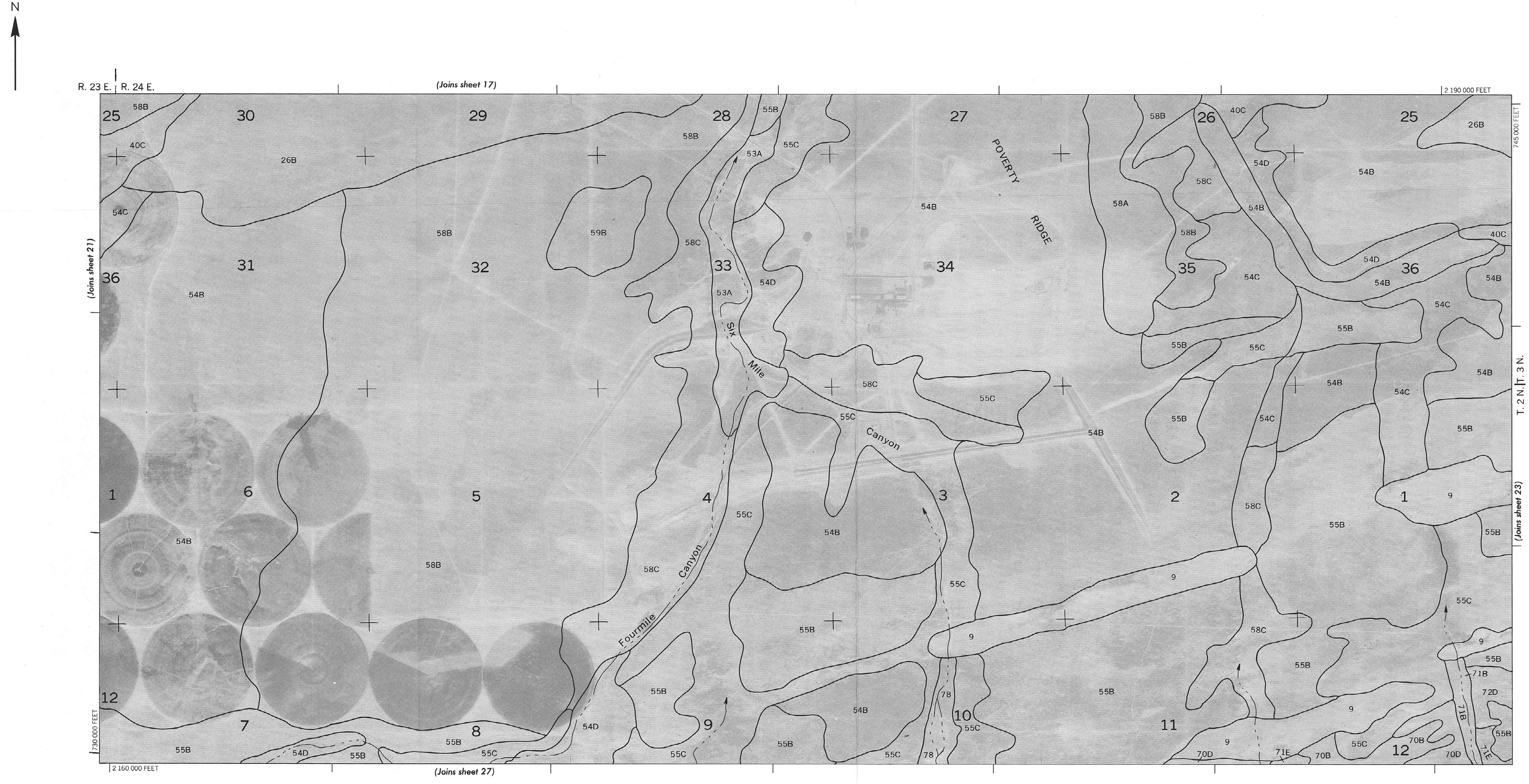
MORROW COUNTY, OREGON — SHEET NUMBER 21

MORROW COUNTY, OREGON NO. 21

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
(Joins sheet 16)
(Joins sheet 22)
(Joins sheet 26)
R. 23 E.
T. 3 N.
T. 2 N.
2 130 000 FEET
2 155 000 FEET
740 000 FEET
730 000 FEET
GILLIAM COUNTY
Willow Creek
UNION PACIFIC
74
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
7
8
9
10
11
12
9
22
12
49F
71E
26B
26C
40C
54B
54C
54D
55B
55C
58B
58C
SCALE 1:24000
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

MORROW COUNTY, OREGON — SHEET NUMBER 22


N
R. 23 E. | R. 24 E.
(Joins sheet 17)
2 190 000 FEET
745 000 FEET
(Joins sheet 21)
(Joins sheet 23)
T. 2 N. | T. 3 N.
730 000 FEET
2 160 000 FEET
(Joins sheet 27)
25
30
29
28
27
26
25
31
32
33
34
35
36
36
1
6
5
4
3
2
1
12
7
8
9
10
11
12
58B
40C
26B
54C
54B
58B
59B
58C
55B
55C
53A
54D
53A
Six Mile Canyon
Fourmile Canyon
POVERTY RIDGE
58A
58C
58B
54D
54B
54C
40C
54D
55B
55C
54C
54B
58C
55C
55C
54B
55B
54C
55B
9
58C
55B
55C
9
9
55B
54B
58B
58C
55C
55B
54D
55B
55C
55B
54B
78
78
55C
55C
55B
70D
71E
70B
55C
70B
70D
71B
72D
71B
71E
55B
55B
9
9
9
58C
55B
55C

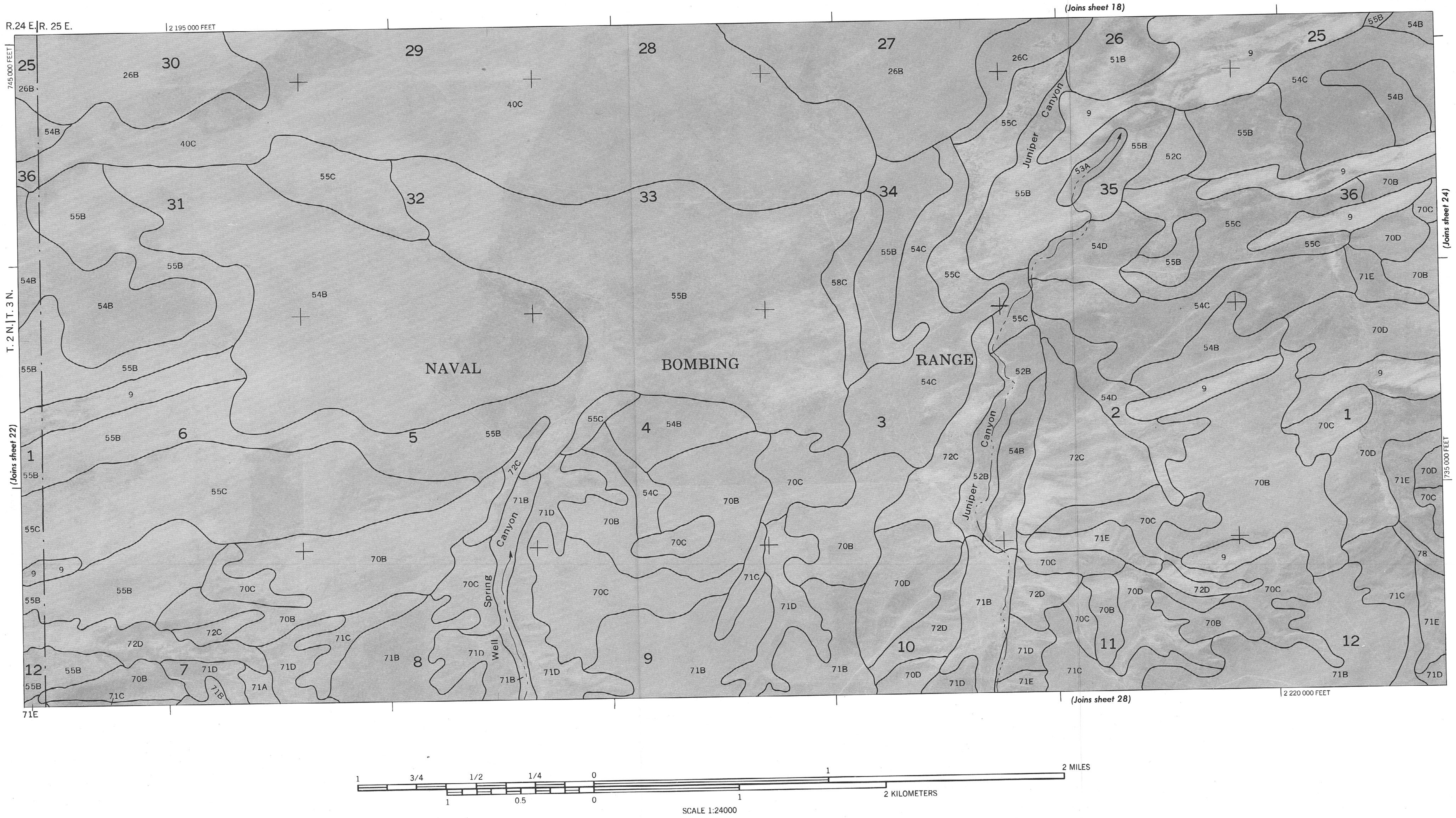
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON — SHEET NUMBER 23

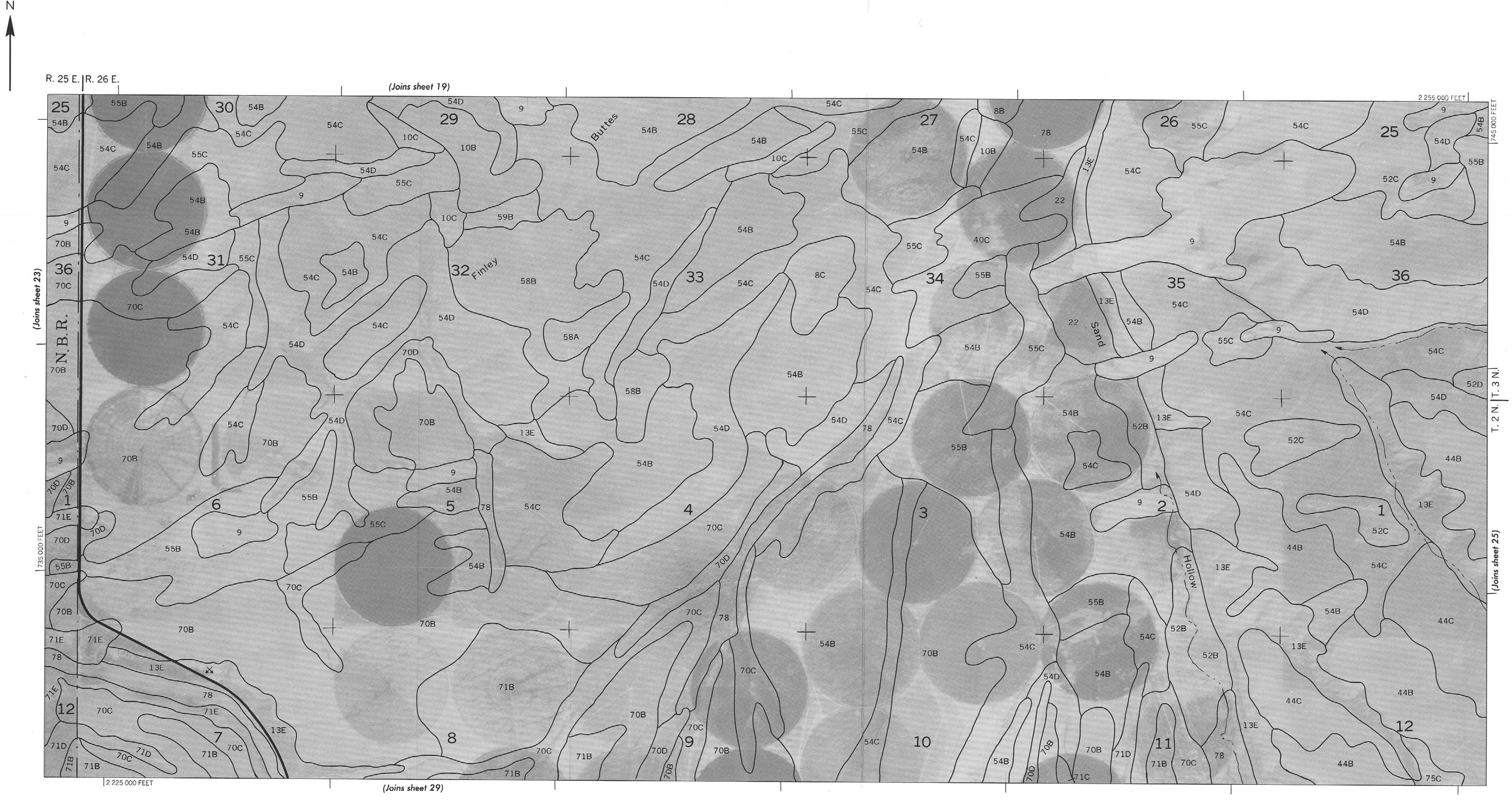

(Joins sheet 18)
R.24 E.
R. 25 E.
2 195 000 FEET
745 000 FEET
T. 2 N.
T. 3 N.
(Joins sheet 22)
(Joins sheet 24)
735 000 FEET
(Joins sheet 28)
2 220 000 FEET
NAVAL
BOMBING
RANGE
Juniper Canyon
Spring Well Canyon
25
30
29
28
27
26
36
31
32
33
34
35
1
6
5
4
3
2
12
7
8
9
10
11
26B
40C
54B
55B
55C
9
51B
26C
54C
52C
53A
54D
58C
70B
70C
70D
71A
71B
71C
71D
71E
72C
72D
52B
78
1
3/4
1/2
1/4
0
2 MILES
0.5
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON NO. 23

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

MORROW COUNTY, OREGON — SHEET NUMBER 24


N
R. 25 E.
R. 26 E.
(Joins sheet 19)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 29)
T. 3 N.
T. 2 N.
2 255 000 FEET
745 000 FEET
735 000 FEET
2 225 000 FEET
N.B.R.
Buttes
Finley
Sand
Hollow
25
30
29
28
27
26
25
36
31
32
33
34
35
36
1
6
5
4
3
2
1
12
7
8
9
10
11
12

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

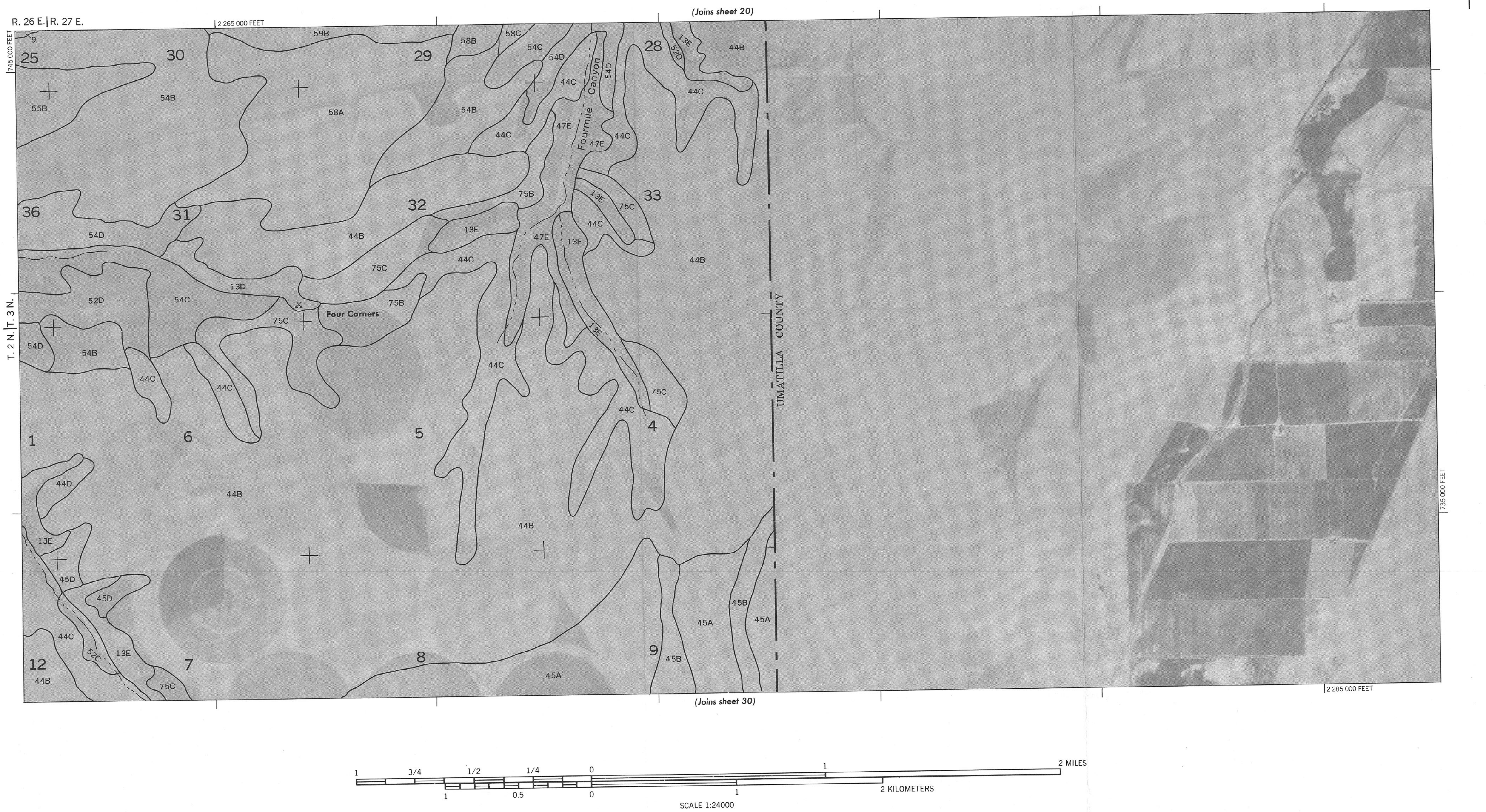
MORROW COUNTY, OREGON — SHEET NUMBER 25

MORROW COUNTY, OREGON NO. 25

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

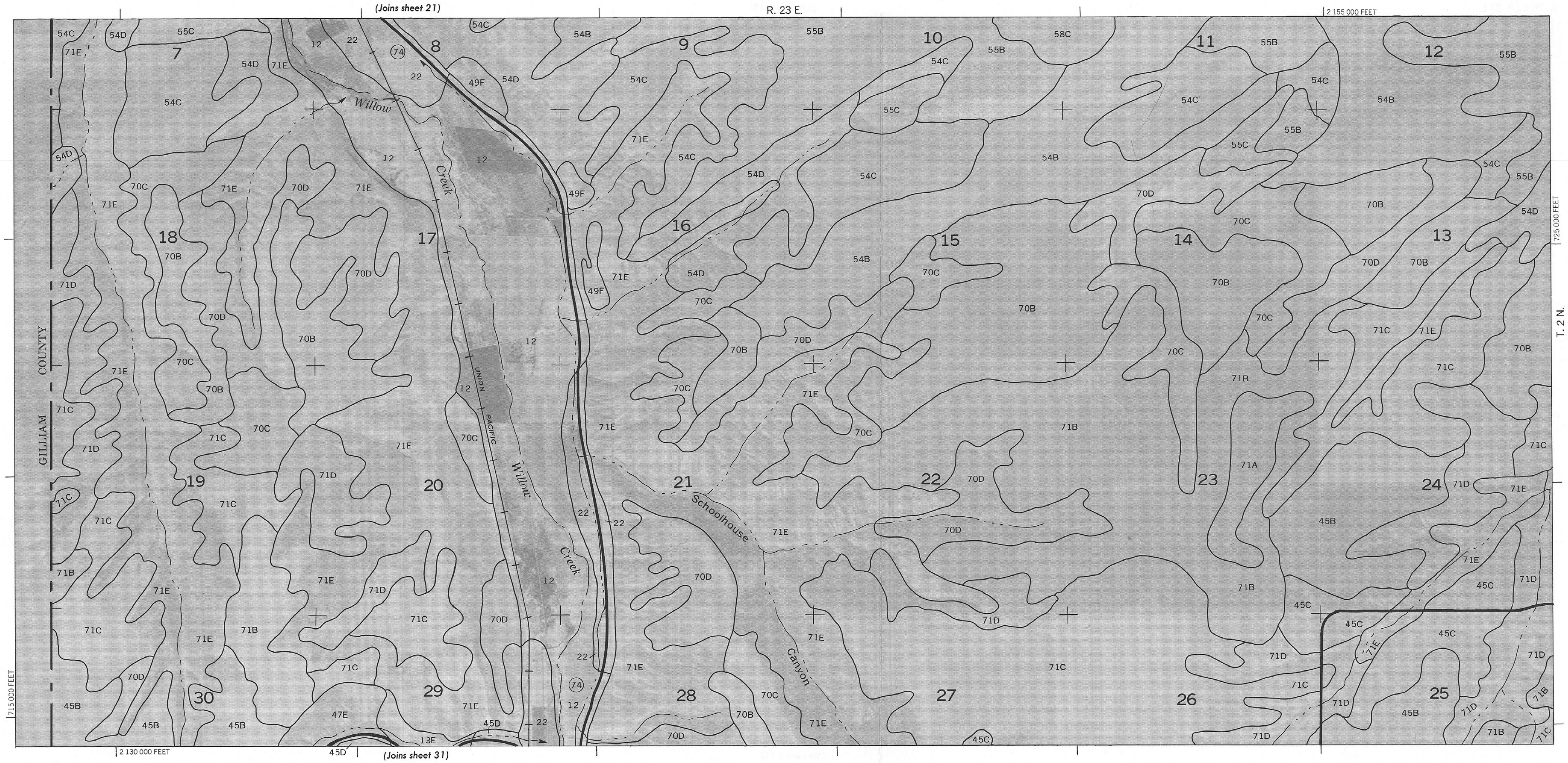
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

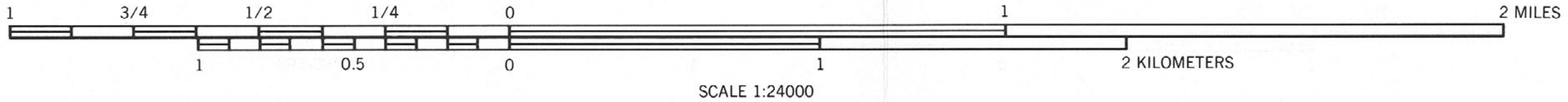

N
(Joins sheet 20)
(Joins sheet 30)
R. 26 E. | R. 27 E.
T. 2 N. | T. 3 N.
2 265 000 FEET
2 285 000 FEET
745 000 FEET
735 000 FEET
UMATILLA COUNTY
Fourmile Canyon
Four Corners
25
30
29
28
36
31
32
33
1
6
5
4
12
7
8
9
55B
54B
59B
58A
58B
58C
54C
54D
44C
47E
75B
13E
75C
44B
54D
52D
13D
54C
75C
75B
54B
44C
44D
13E
45D
52C
44B
45A
45B
9
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

(26)

N

MORROW COUNTY, OREGON — SHEET NUMBER 26


(Joins sheet 21)
R. 23 E.
2 155 000 FEET
725 000 FEET
T. 2 N.
715 000 FEET
2 130 000 FEET
(Joins sheet 31)
GILLIAM COUNTY
Willow
Creek
Willow
Creek
UNION PACIFIC
Schoolhouse
Canyon
74
74
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
12
13E
22
45B
45C
45D
47E
49F
54B
54C
54D
55B
55C
58C
70B
70C
70D
71A
71B
71C
71D
71E


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

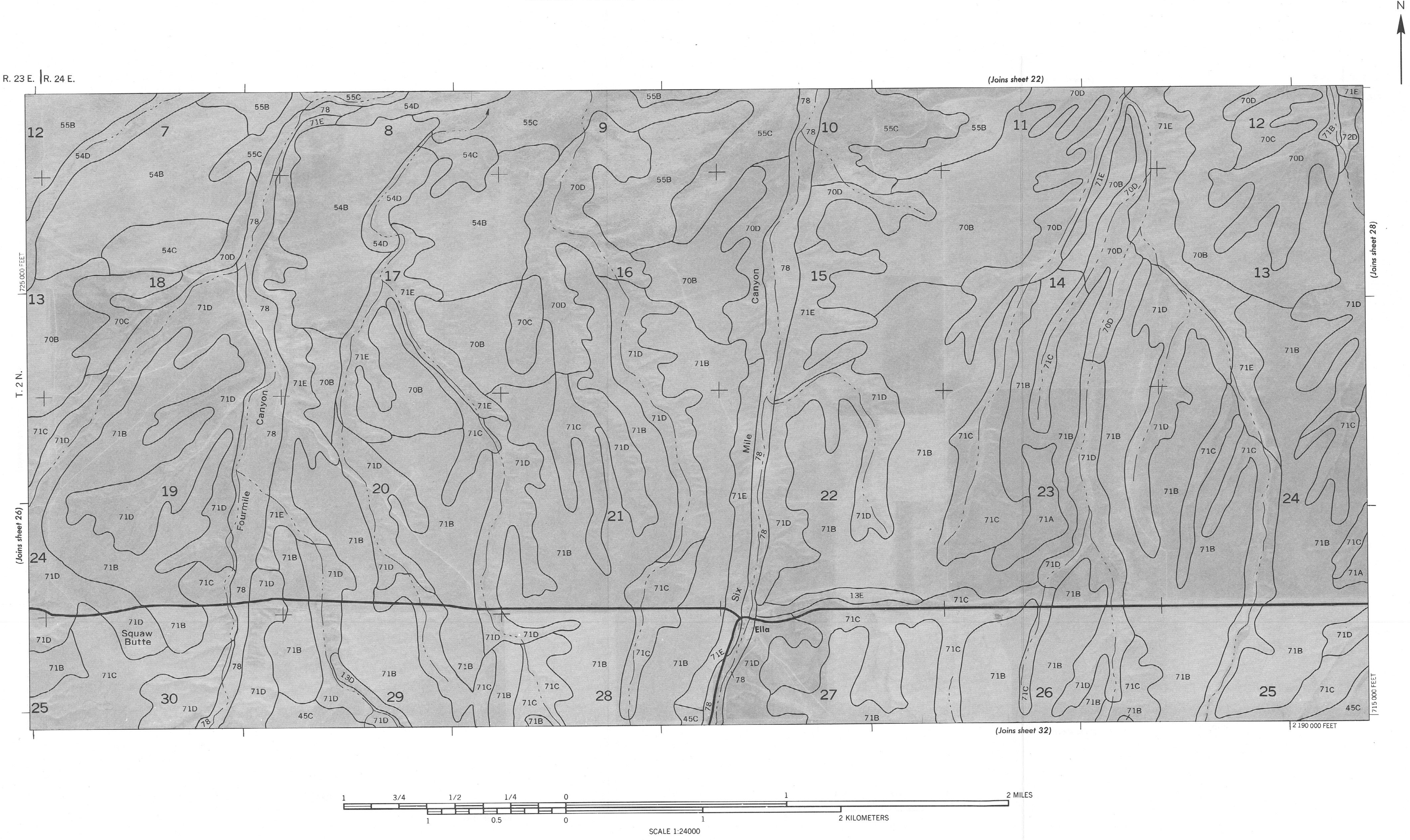
Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 26

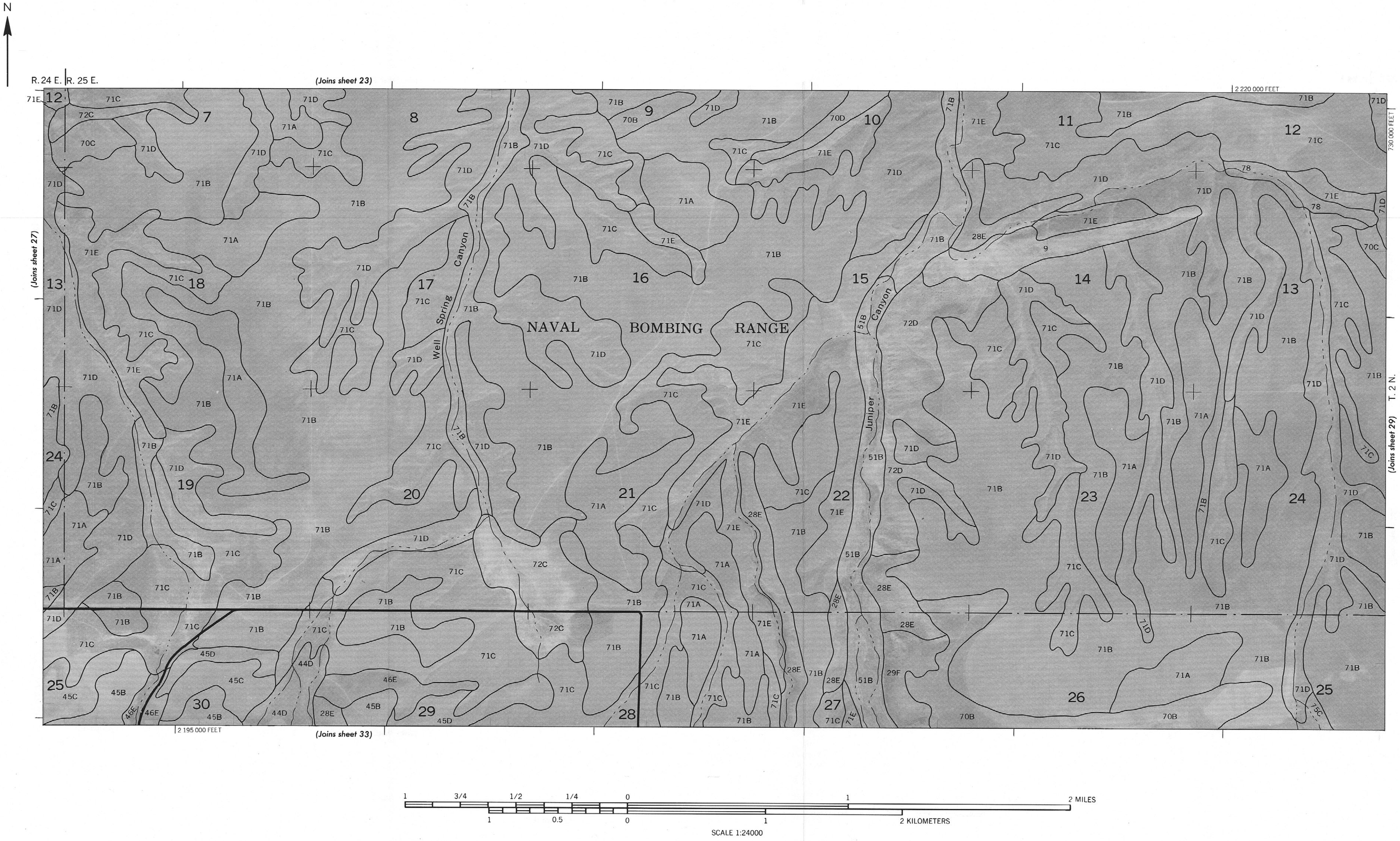
MORROW COUNTY, OREGON — SHEET NUMBER 27

MORROW COUNTY, OREGON NO. 27

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
R. 23 E.
R. 24 E.
T. 2 N.
(Joins sheet 22)
(Joins sheet 28)
(Joins sheet 32)
(Joins sheet 26)
725 000 FEET
715 000 FEET
2 190 000 FEET
12
7
8
9
10
11
12
13
18
17
16
15
14
13
24
19
20
21
22
23
24
25
30
29
28
27
26
25
Fourmile
Canyon
Six
Mile
Canyon
Squaw Butte
Ella
55B
54D
54B
54C
55C
78
71E
54D
55C
55B
70D
55C
55B
70D
55C
55B
70D
71E
70B
70C
70D
72D
71B
71D
71C
71A
70B
70C
13E
13D
45C
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

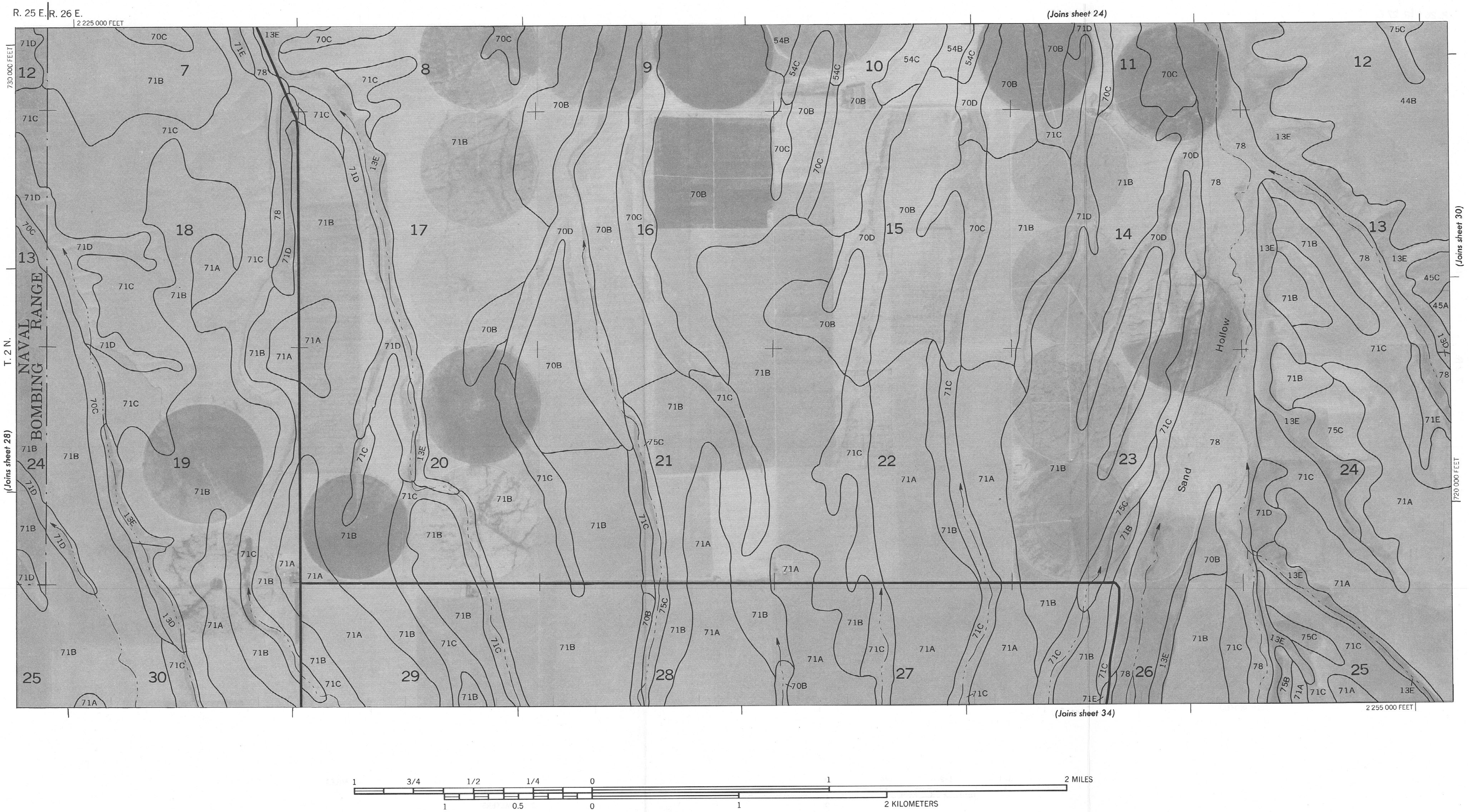
MORROW COUNTY, OREGON — SHEET NUMBER 28


N
R. 24 E.
R. 25 E.
(Joins sheet 23)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 33)
2 220 000 FEET
730 000 FEET
2 195 000 FEET
T. 2 N.
NAVAL BOMBING RANGE
Well Spring Canyon
Juniper Canyon
12
7
8
9
10
11
12
13
18
17
16
15
14
13
24
19
20
21
22
23
24
25
30
29
28
27
26
25
71E
71C
71D
72C
70C
71A
71B
70B
70D
78
9
28E
72D
71E
51B
72D
29F
44D
45B
45C
45D
46E
70B
75C
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 28

MORROW COUNTY, OREGON — SHEET NUMBER 29

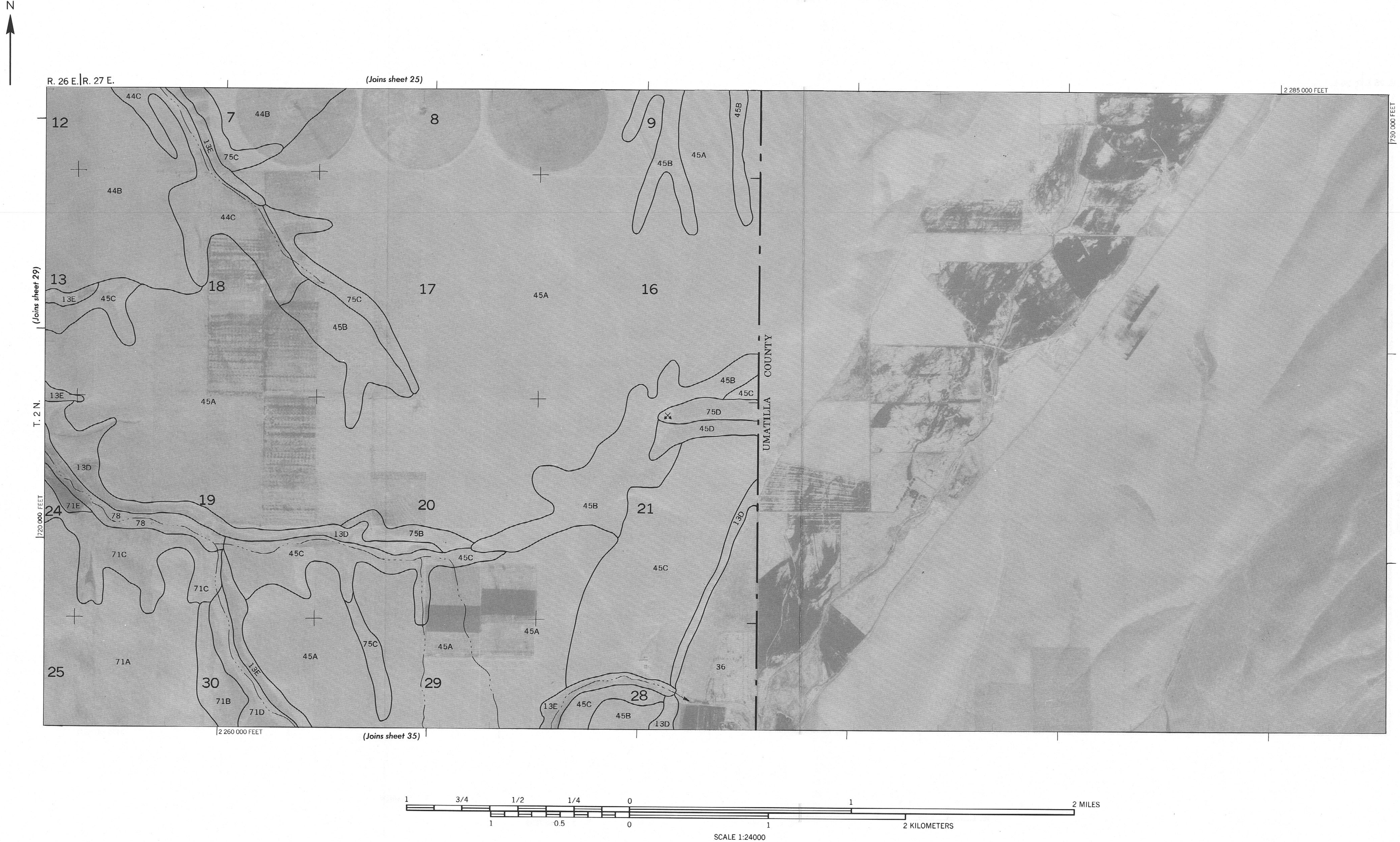

N
R. 25 E.
R. 26 E.
2 225 000 FEET
730 000 FEET
720 000 FEET
2 255 000 FEET
T. 2 N.
(Joins sheet 24)
(Joins sheet 30)
(Joins sheet 34)
(Joins sheet 28)
NAVAL BOMBING RANGE
Sand Hollow
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
70B
70C
70D
71A
71B
71C
71D
71E
13D
13E
44B
45A
45C
54B
54C
75B
75C
78
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

MORROW COUNTY, OREGON NO. 29

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

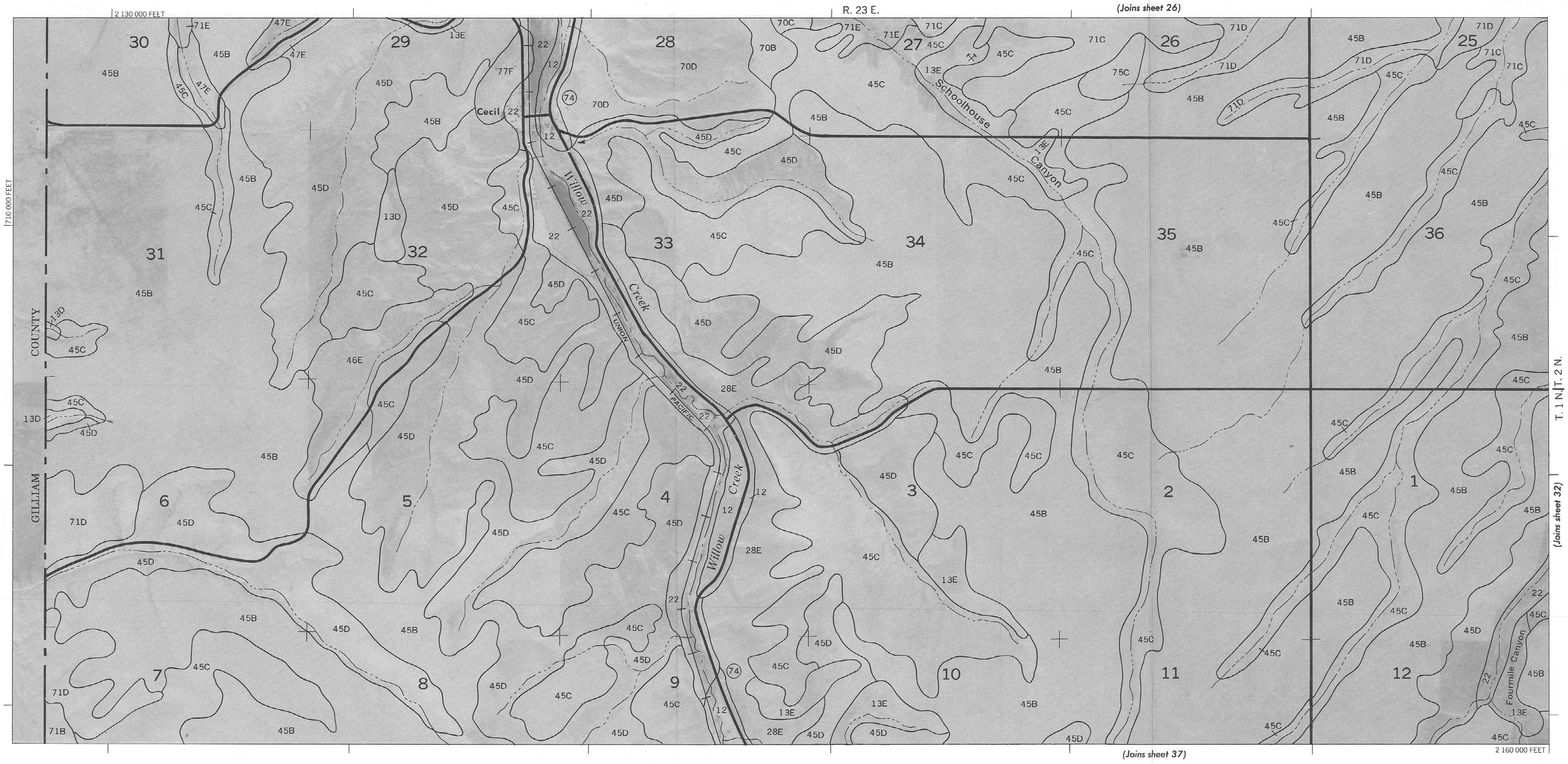
MORROW COUNTY, OREGON — SHEET NUMBER 30


N
R. 26 E.
R. 27 E.
(Joins sheet 25)
(Joins sheet 29)
(Joins sheet 35)
T. 2 N.
2 285 000 FEET
730 000 FEET
720 000 FEET
2 260 000 FEET
UMATILLA COUNTY
12
7
8
9
13
18
17
16
24
19
20
21
25
30
29
28
44C
44B
13E
75C
45B
45A
45C
75D
45D
13D
71E
78
71C
71A
71B
71D
75B
36
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

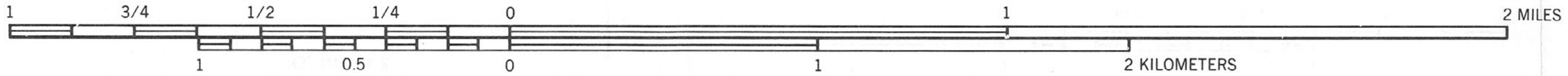
Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON — SHEET NUMBER 31

㉛



2 130 000 FEET
R. 23 E.
(Joins sheet 26)
710 000 FEET
T. 1 N.
T. 2 N.
(Joins sheet 32)
(Joins sheet 37)
2 160 000 FEET
GILLIAM
COUNTY
Cecil
Willow
Creek
Schoolhouse
Canyon
Fourmile Canyon
UNION
PACIFIC
74
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
7
8
9
10
11
12
45B
45C
45D
46E
47E
71E
71C
71D
71B
70C
70B
70D
77F
75C
13D
13E
22
12
28E



1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

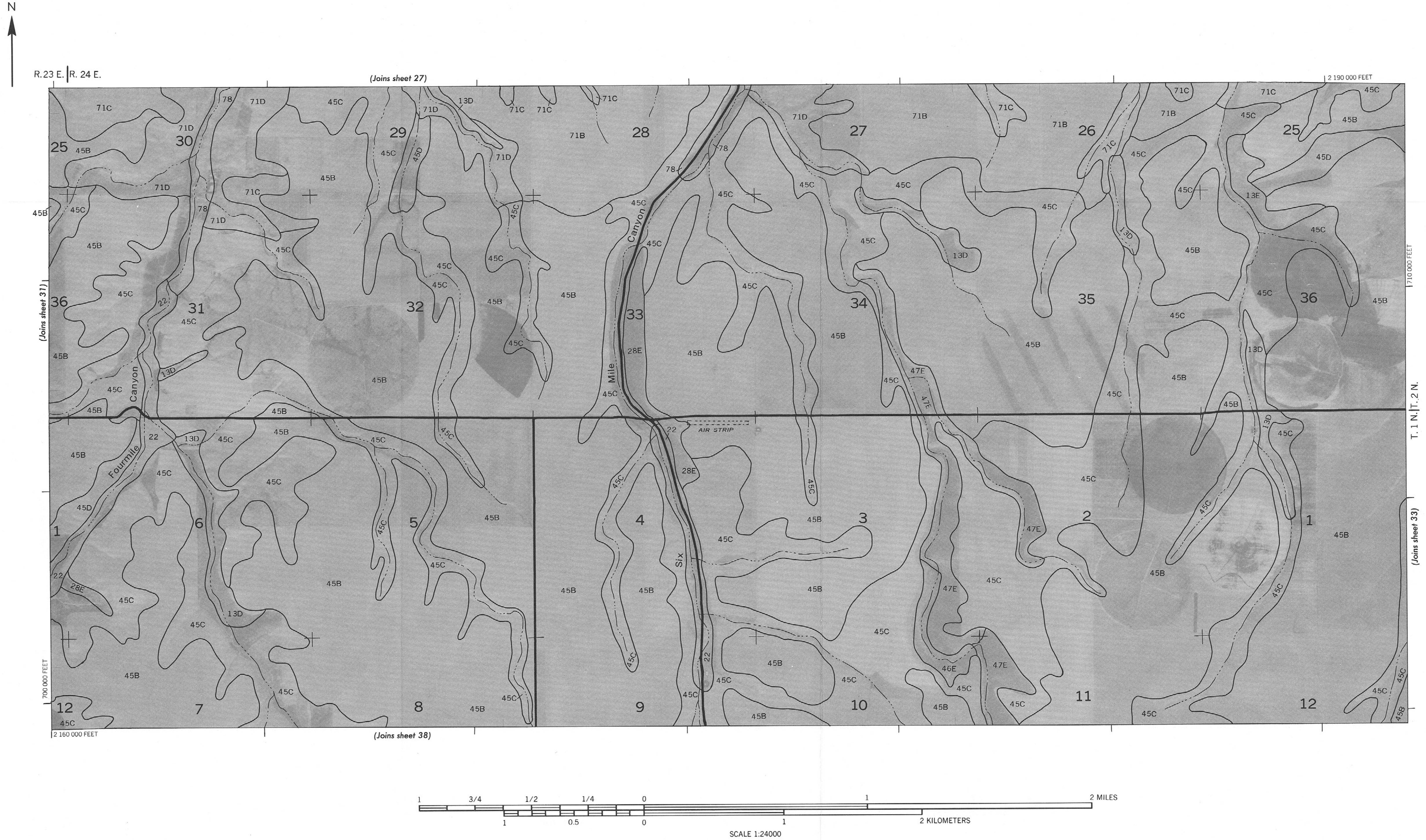
SCALE 1:24000

MORROW COUNTY, OREGON NO. 31

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

㉜

MORROW COUNTY, OREGON — SHEET NUMBER 32


N
R.23 E. R. 24 E.
(Joins sheet 27)
(Joins sheet 38)
(Joins sheet 31)
(Joins sheet 33)
2 190 000 FEET
2 160 000 FEET
710 000 FEET
700 000 FEET
T. 1 N. T. 2 N.
25
30
29
28
27
26
36
31
32
33
34
35
1
6
5
4
3
2
12
7
8
9
10
11
Fourmile Canyon
Six Mile Canyon
AIR STRIP
71C
71D
71B
78
13D
13E
45B
45C
45D
22
28E
47E
47F
46E
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

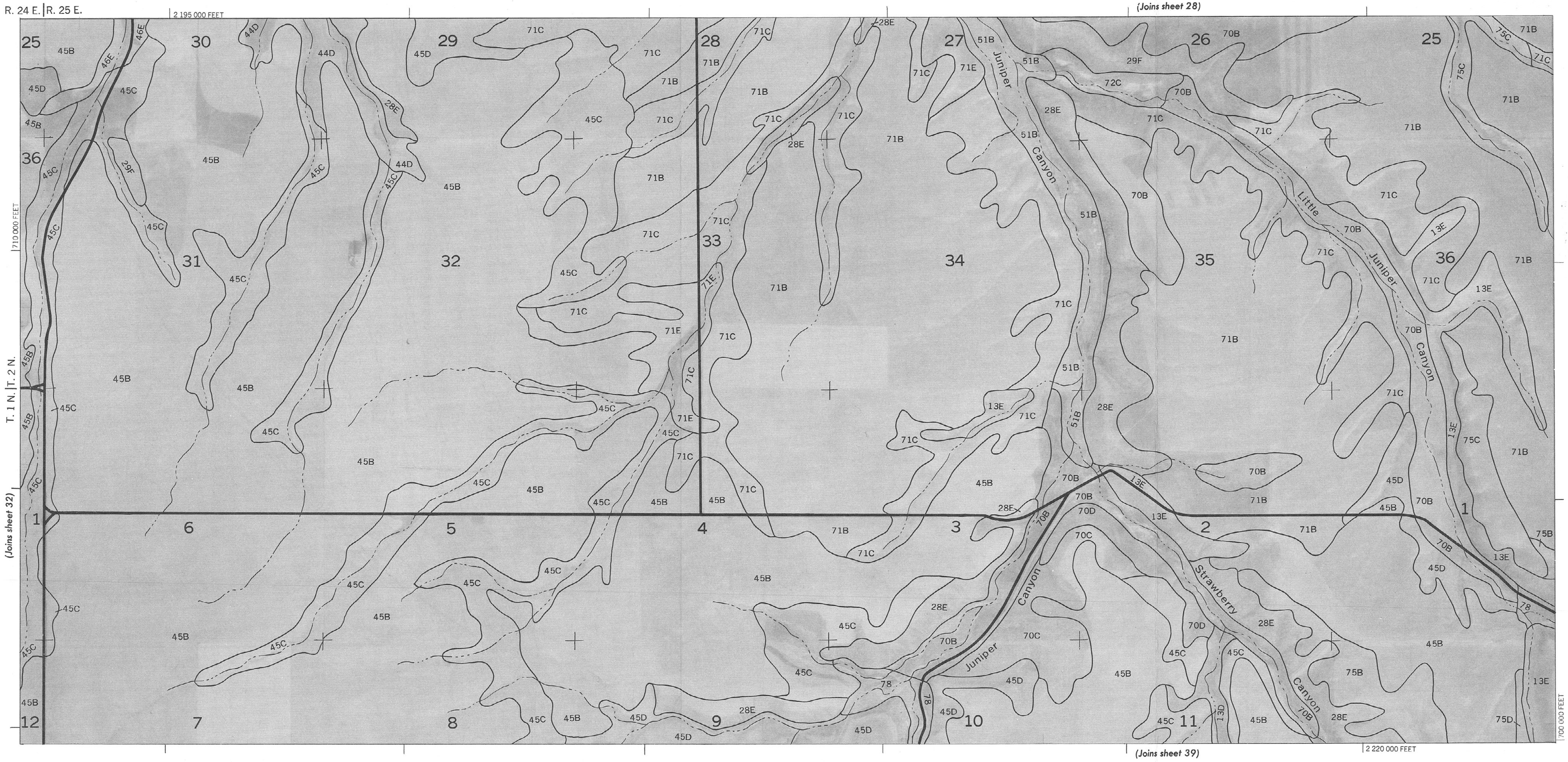
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 32

MORROW COUNTY, OREGON — SHEET NUMBER 33


R. 24 E. | R. 25 E.
2 195 000 FEET
(Joins sheet 28)
(Joins sheet 32)
(Joins sheet 39)
710 000 FEET
700 000 FEET
2 220 000 FEET
T. 1 N. | T. 2 N.
25
30
29
28
27
26
25
36
31
32
33
34
35
36
1
6
5
4
3
2
1
12
7
8
9
10
11
Juniper Canyon
Little Juniper Canyon
Strawberry Canyon
78
45B
45C
45D
44D
46E
29F
28E
71B
71C
71E
51B
70B
70C
70D
72C
13E
13D
75B
75C
75D

MORROW COUNTY, OREGON NO. 33

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES

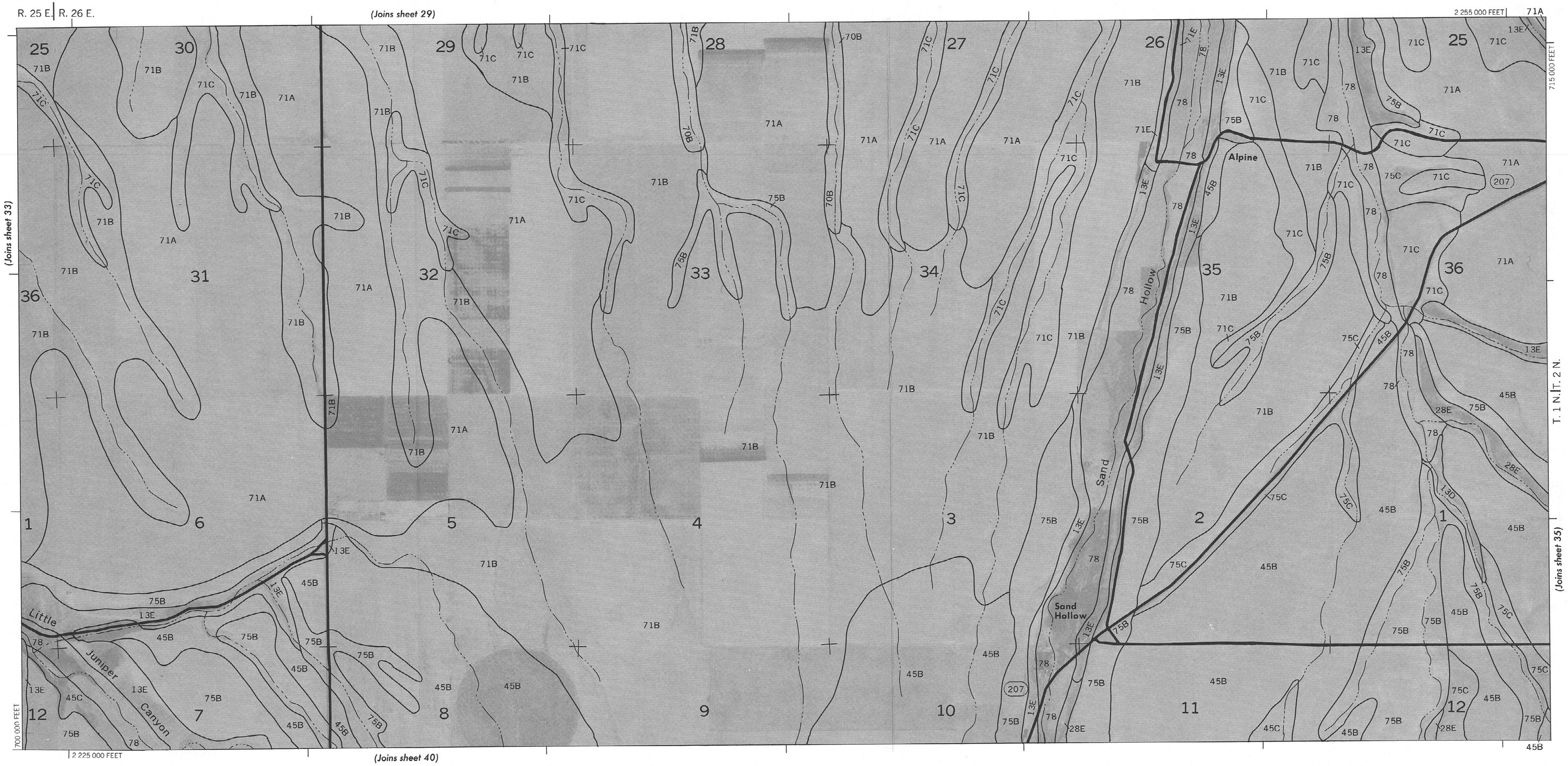
1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

㉞

N

MORROW COUNTY, OREGON — SHEET NUMBER 34


R. 25 E.
R. 26 E.
(Joins sheet 29)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 40)
T. 1 N.
T. 2 N.
2 225 000 FEET
2 255 000 FEET
700 000 FEET
715 000 FEET
Alpine
Sand Hollow
Little Juniper Canyon
207
25
30
29
28
27
26
36
31
32
33
34
35
1
6
5
4
3
2
12
7
8
9
10
11
13D
13E
28E
45B
45C
70B
71A
71B
71C
71E
75B
75C
78

1 3/4 1/2 1/4 0 1 2 MILES

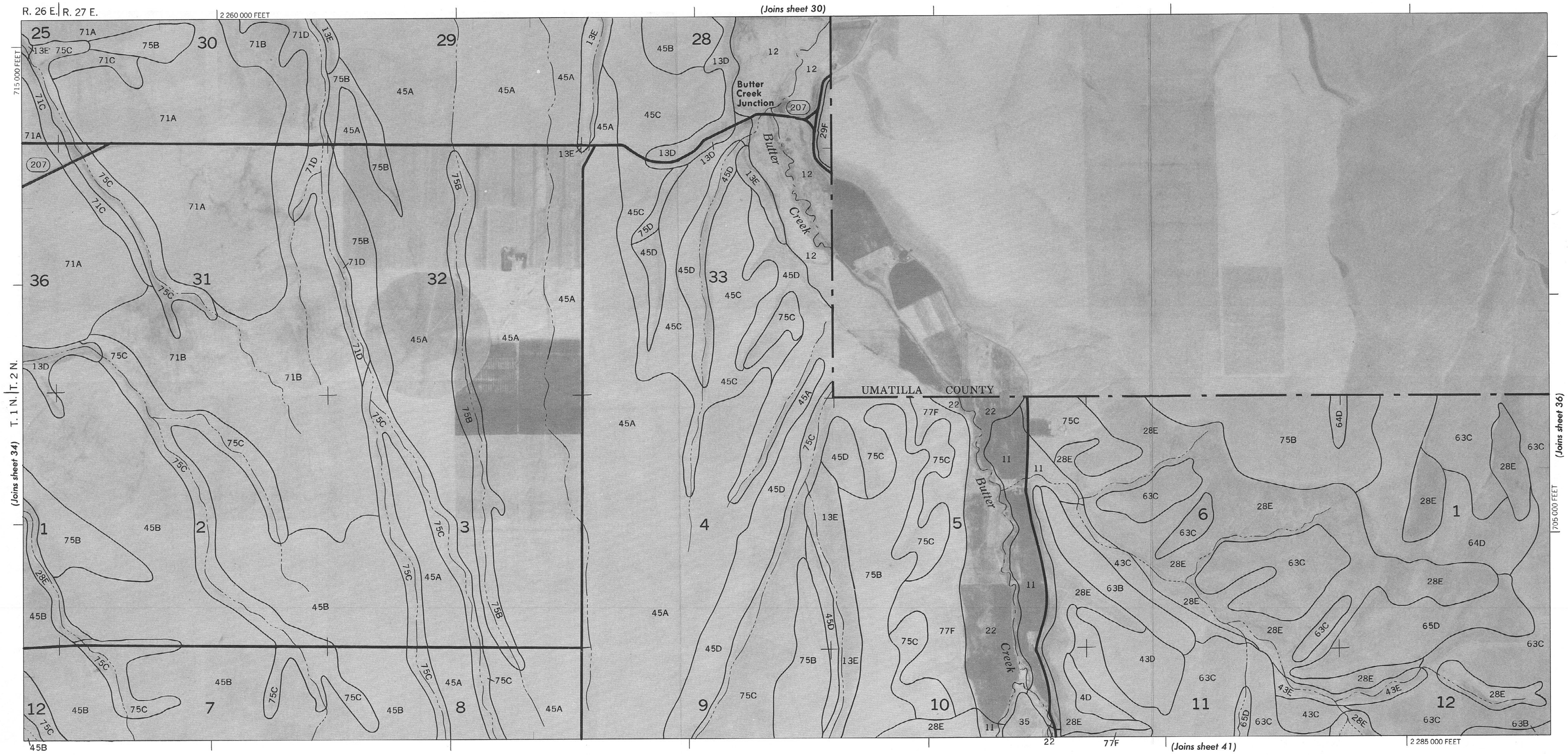
1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

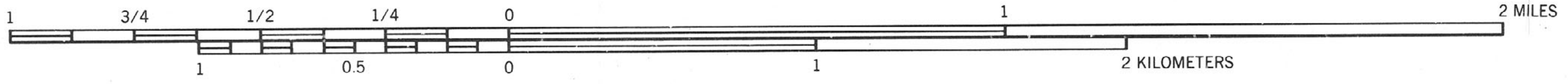
MORROW COUNTY, OREGON NO. 34

MORROW COUNTY, OREGON — SHEET NUMBER 35


N
R. 26 E.
R. 27 E.
2 260 000 FEET
(Joins sheet 30)
715 000 FEET
(Joins sheet 34)
T. 1 N.
T. 2 N.
(Joins sheet 36)
705 000 FEET
(Joins sheet 41)
2 285 000 FEET
UMATILLA COUNTY
Butter Creek Junction
Butter Creek
207
25
30
29
28
36
31
32
33
1
2
3
4
5
6
7
8
9
10
11
12
35
71A
71B
71C
71D
75B
75C
75D
45A
45B
45C
45D
13D
13E
12
11
22
29F
77F
28E
63B
63C
64D
65D
43C
43D
43E
4D

MORROW COUNTY, OREGON NO. 35

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

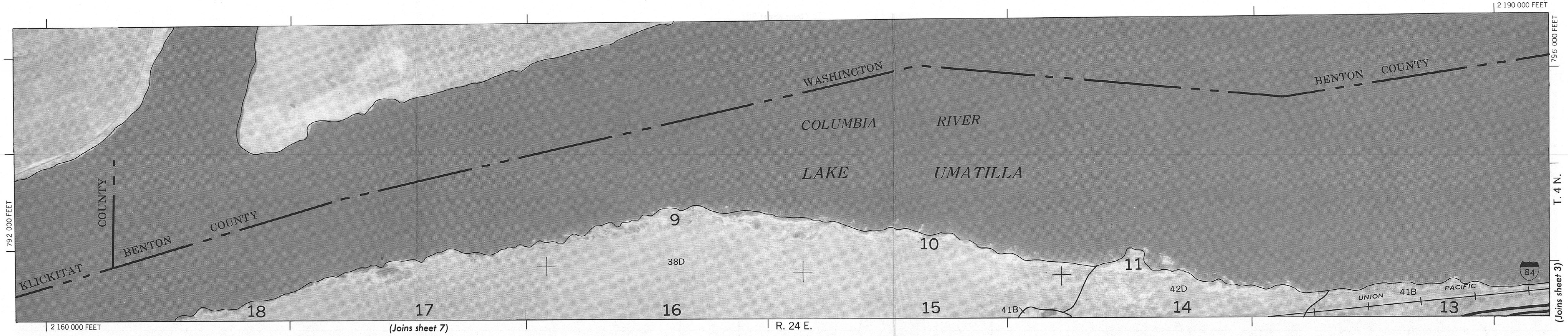

1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

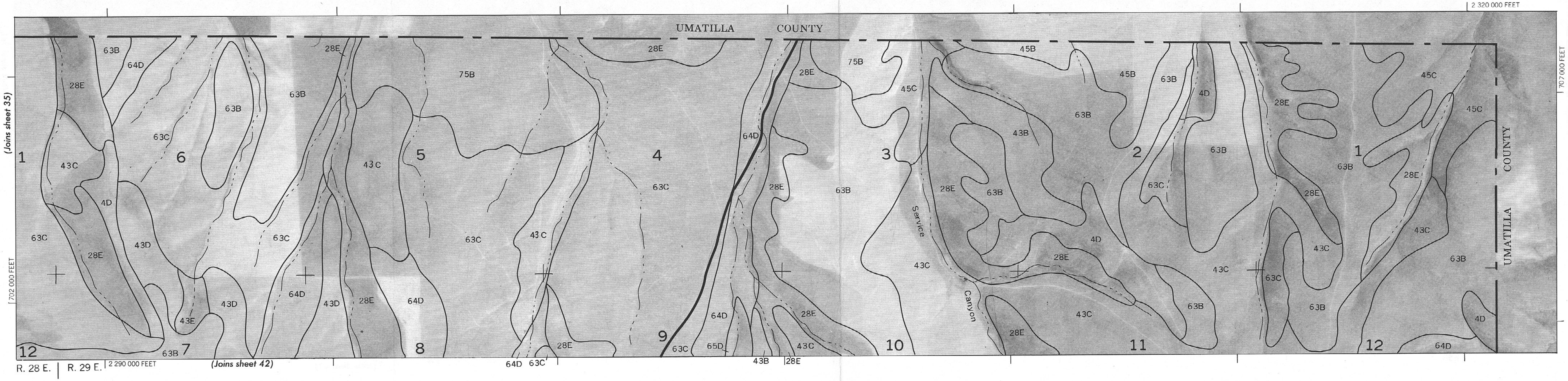
36

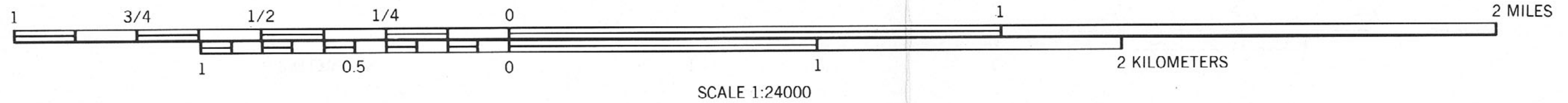
N

MORROW COUNTY, OREGON — SHEET NUMBER 36


2 190 000 FEET
796 000 FEET
WASHINGTON
BENTON COUNTY
KLICKITAT COUNTY
BENTON COUNTY
COLUMBIA RIVER
LAKE UMATILLA
T. 4 N.
792 000 FEET
9
10
11
38D
42D
41B
41B
UNION
PACIFIC
84
18
17
16
15
14
13
(Joins sheet 3)
2 160 000 FEET
(Joins sheet 7)
R. 24 E.

2000 AND 5000 FOOT GRID TICKS


2 320 000 FEET
UMATILLA COUNTY
(Joins sheet 35)
707 000 FEET
702 000 FEET
1
2
3
4
5
6
7
8
9
10
11
12
12
63B
64D
28E
43C
4D
63C
43D
43E
63B
63C
28E
64D
43D
28E
43C
75B
63C
43C
28E
64D
63C
63B
75B
45C
45B
45B
63B
4D
43B
28E
Service Canyon
43C
4D
28E
63B
43C
63C
28E
45C
45C
43C
63B
4D
64D
65D
43B
COUNTY UMATILLA
R. 28 E.
R. 29 E.
2 290 000 FEET
(Joins sheet 42)


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

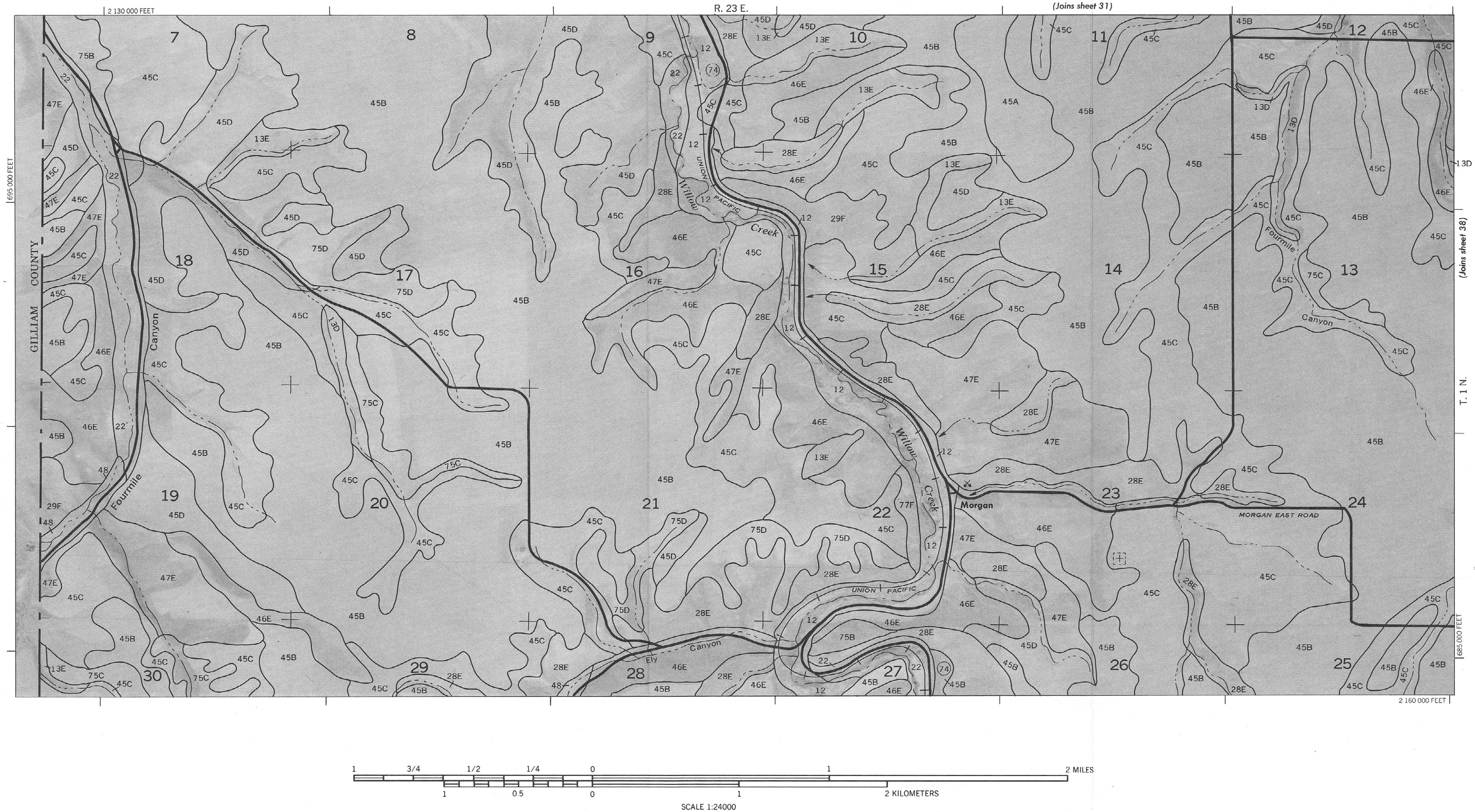
MORROW COUNTY, OREGON NO. 36

MORROW COUNTY, OREGON — SHEET NUMBER 37

MORROW COUNTY, OREGON NO. 37

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

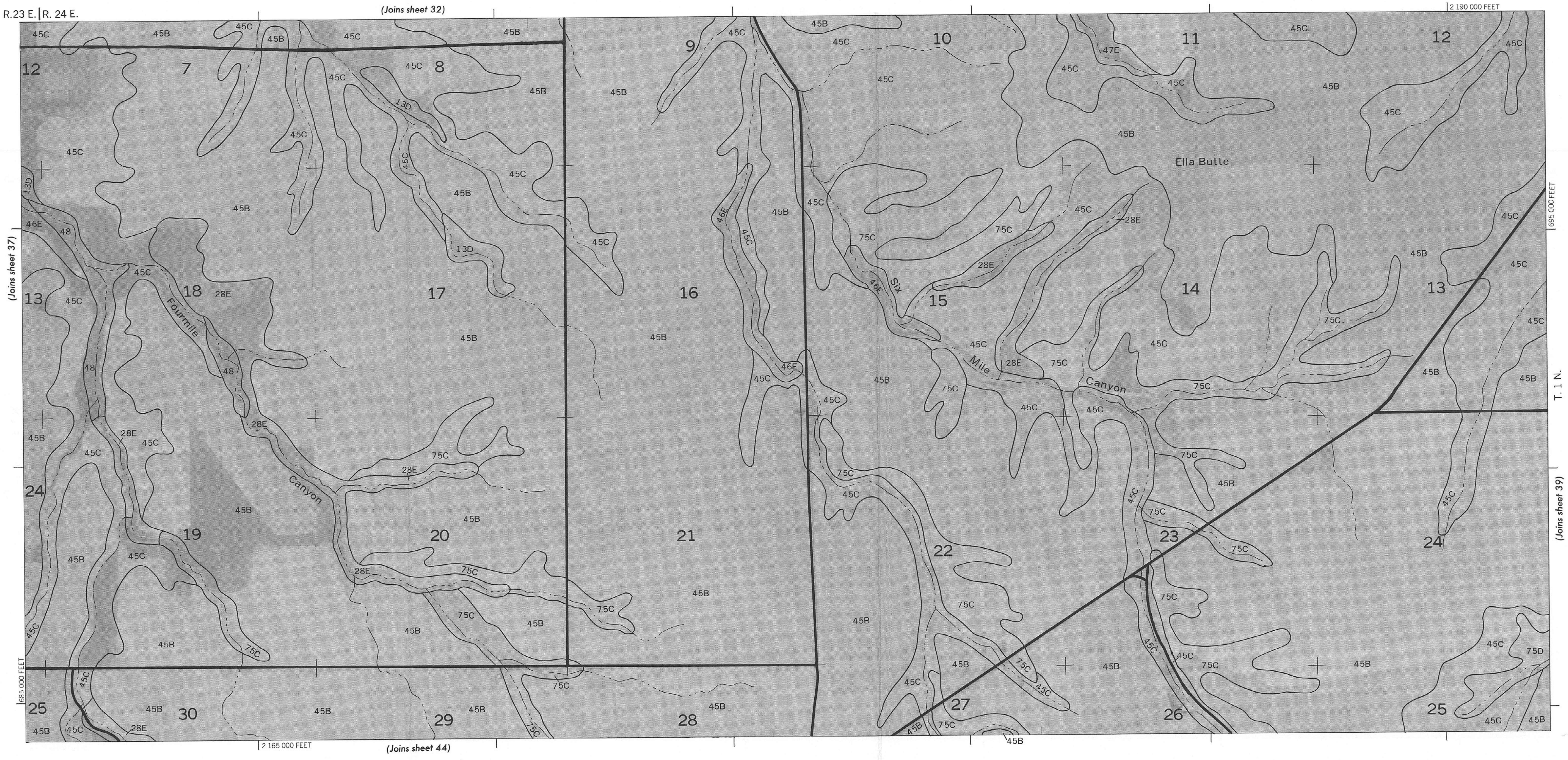
N

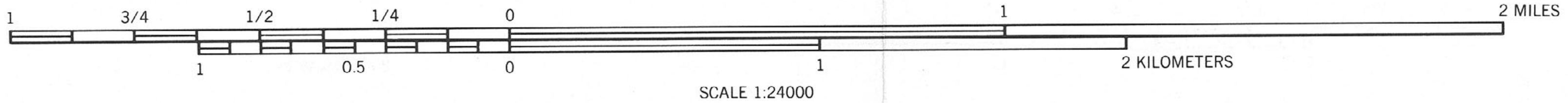

2 130 000 FEET
R. 23 E.
(Joins sheet 31)
(Joins sheet 38)
695 000 FEET
685 000 FEET
2 160 000 FEET
T. 1 N.
GILLIAM COUNTY
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
Fourmile Canyon
Willow Creek
UNION PACIFIC
Ely Canyon
Morgan
MORGAN EAST ROAD
74
45B
45C
45D
45A
46E
47E
28E
13E
13D
12
22
29F
48
75B
75C
75D
77F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

㊳

N

MORROW COUNTY, OREGON — SHEET NUMBER 38


R.23 E. | R. 24 E.
(Joins sheet 32)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 44)
2 190 000 FEET
2 165 000 FEET
695 000 FEET
685 000 FEET
T. 1 N.
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
Ella Butte
Fourmile Canyon
Six Mile Canyon
45B
45C
46E
47E
48
13D
28E
75C
75D


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 38

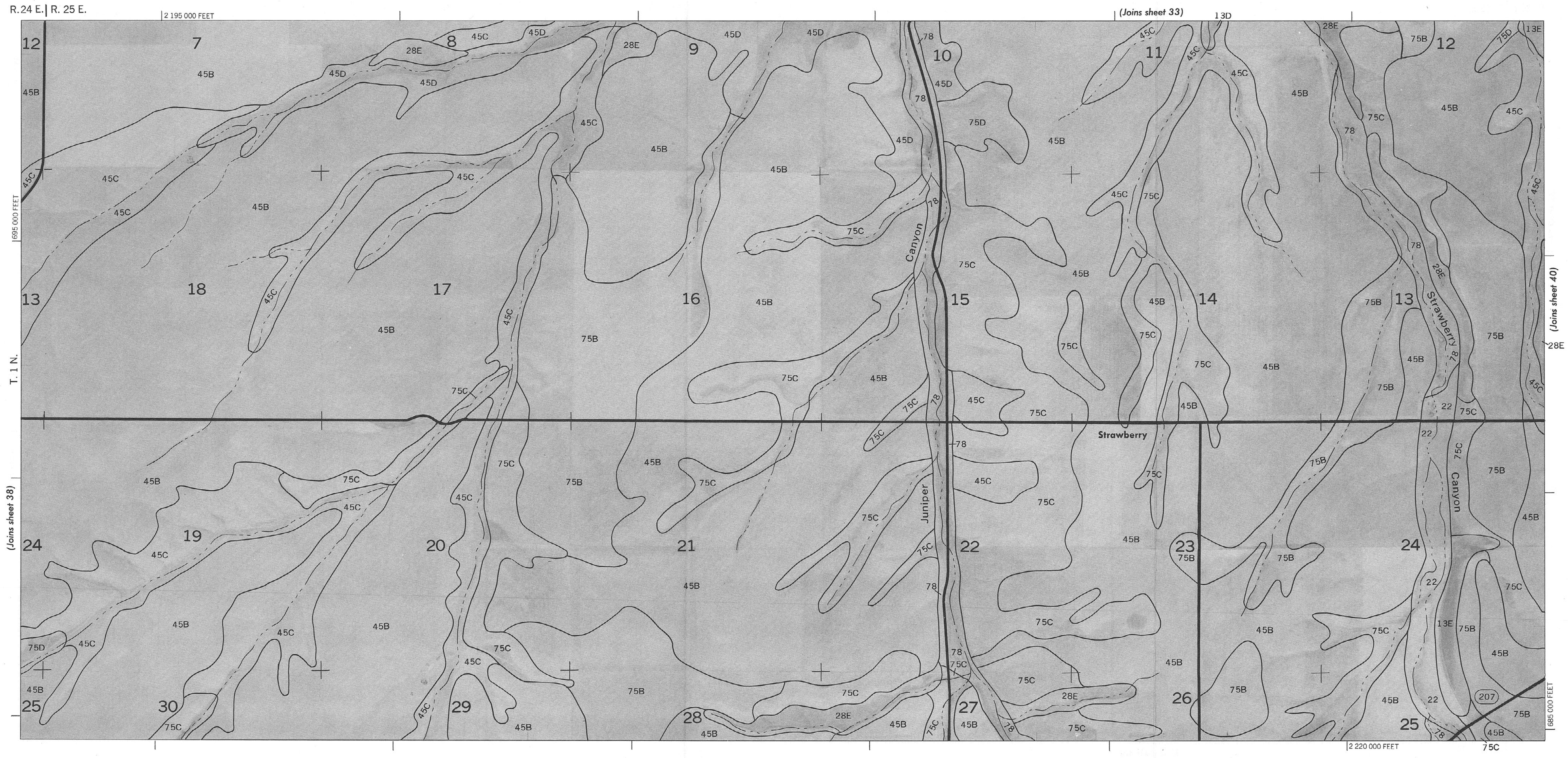
MORROW COUNTY, OREGON — SHEET NUMBER 39

㊴

N

MORROW COUNTY, OREGON NO. 39

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



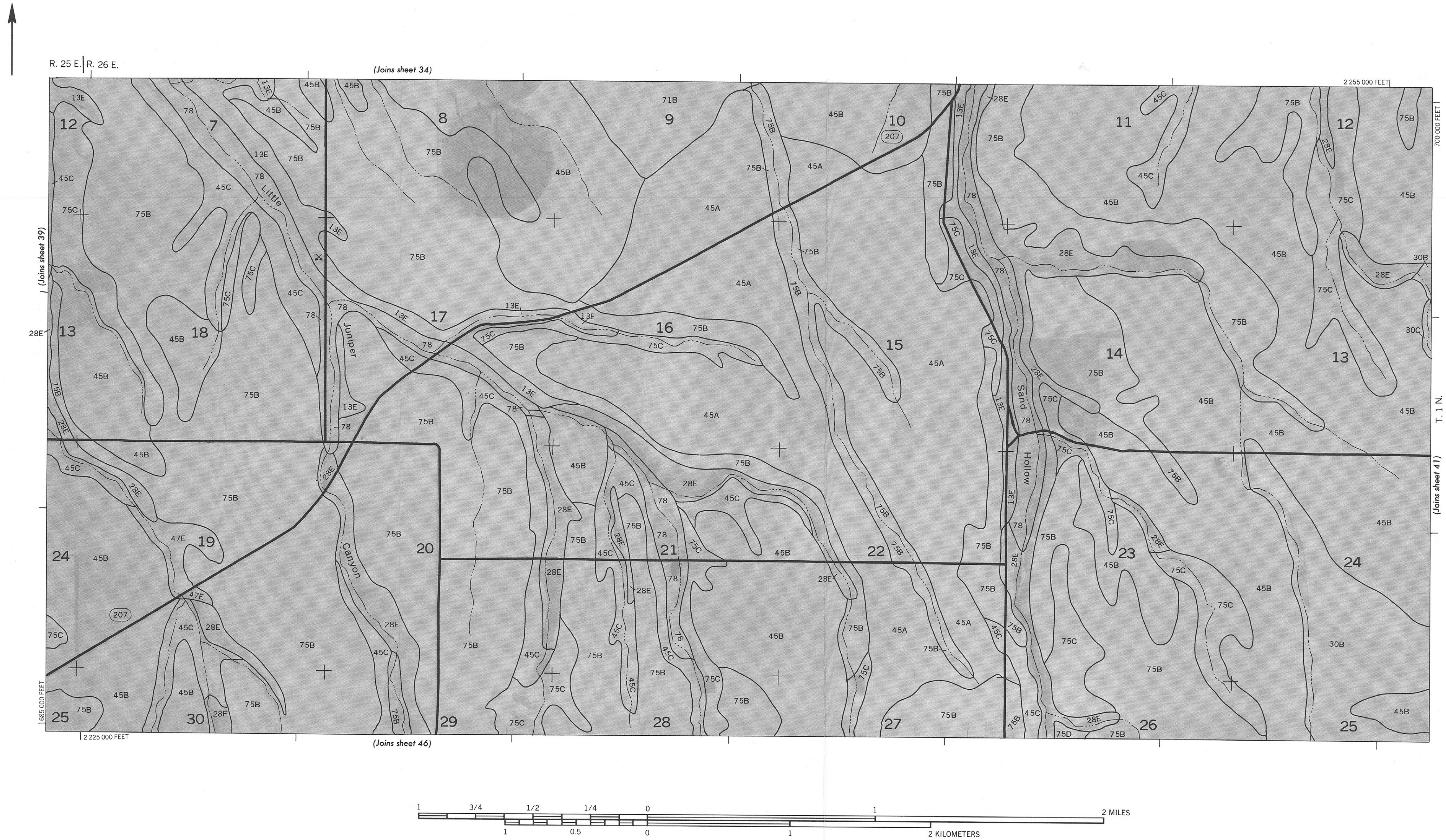
R.24 E.
R.25 E.
2 195 000 FEET
(Joins sheet 33)
13D
695 000 FEET
T. 1 N.
(Joins sheet 38)
(Joins sheet 40)
28E
685 000 FEET
2 220 000 FEET
75C
12
7
8
9
10
11
12
13
18
17
16
15
14
13
24
19
20
21
22
23
24
25
30
29
28
27
26
25
45B
45C
45D
28E
75B
75C
75D
13E
78
22
Canyon
Juniper
Strawberry
Strawberry
Canyon
207

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 40


N
R. 25 E.
R. 26 E.
(Joins sheet 34)
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 46)
T. 1 N.
2 255 000 FEET
2 225 000 FEET
700 000 FEET
685 000 FEET
12
7
8
9
10
11
12
13
18
17
16
15
14
13
24
19
20
21
22
23
24
25
30
29
28
27
26
25
Little
Juniper
Canyon
Sand
Hollow
207
13E
28E
30B
30C
45A
45B
45C
47E
71B
75B
75C
75D
78
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

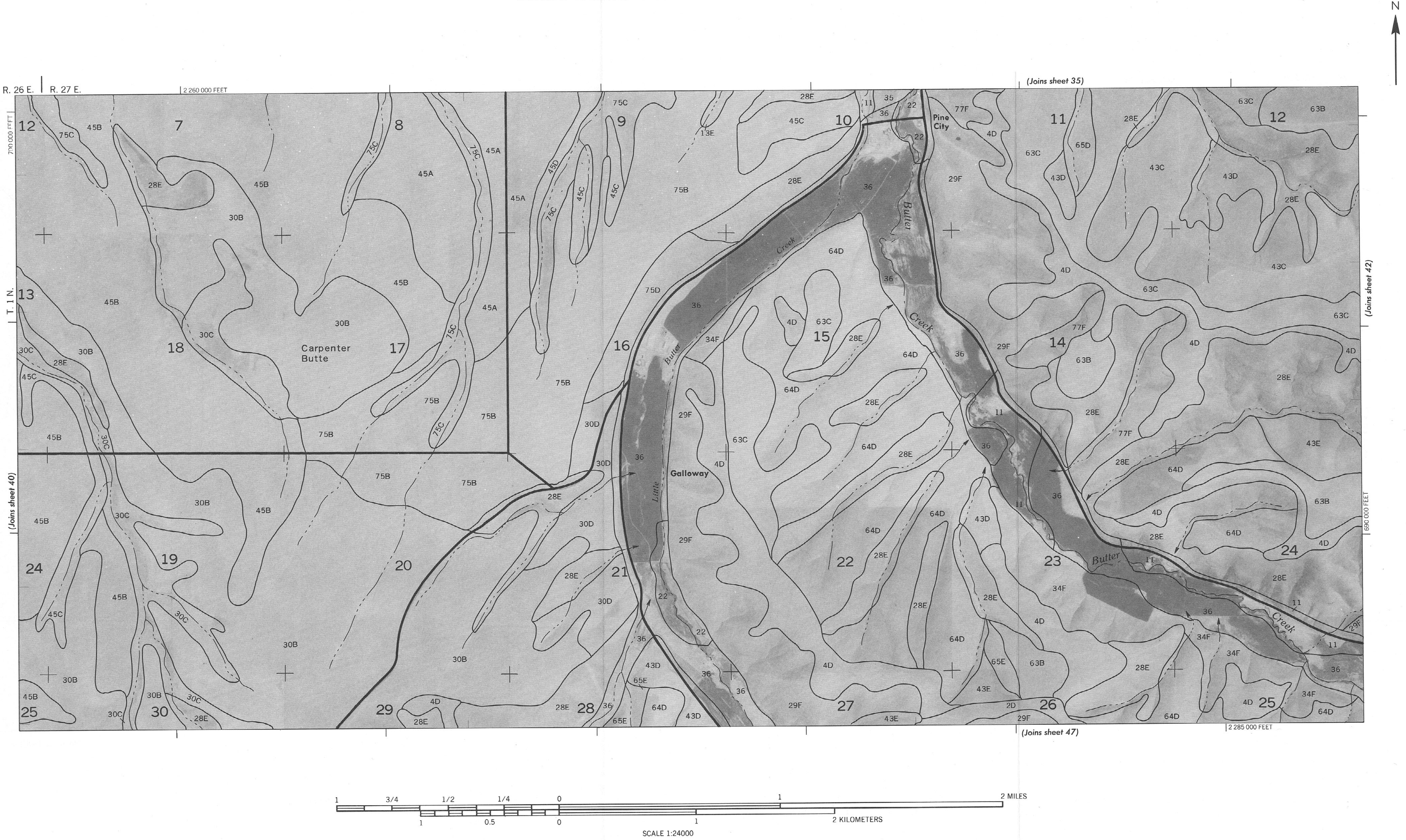
Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 40

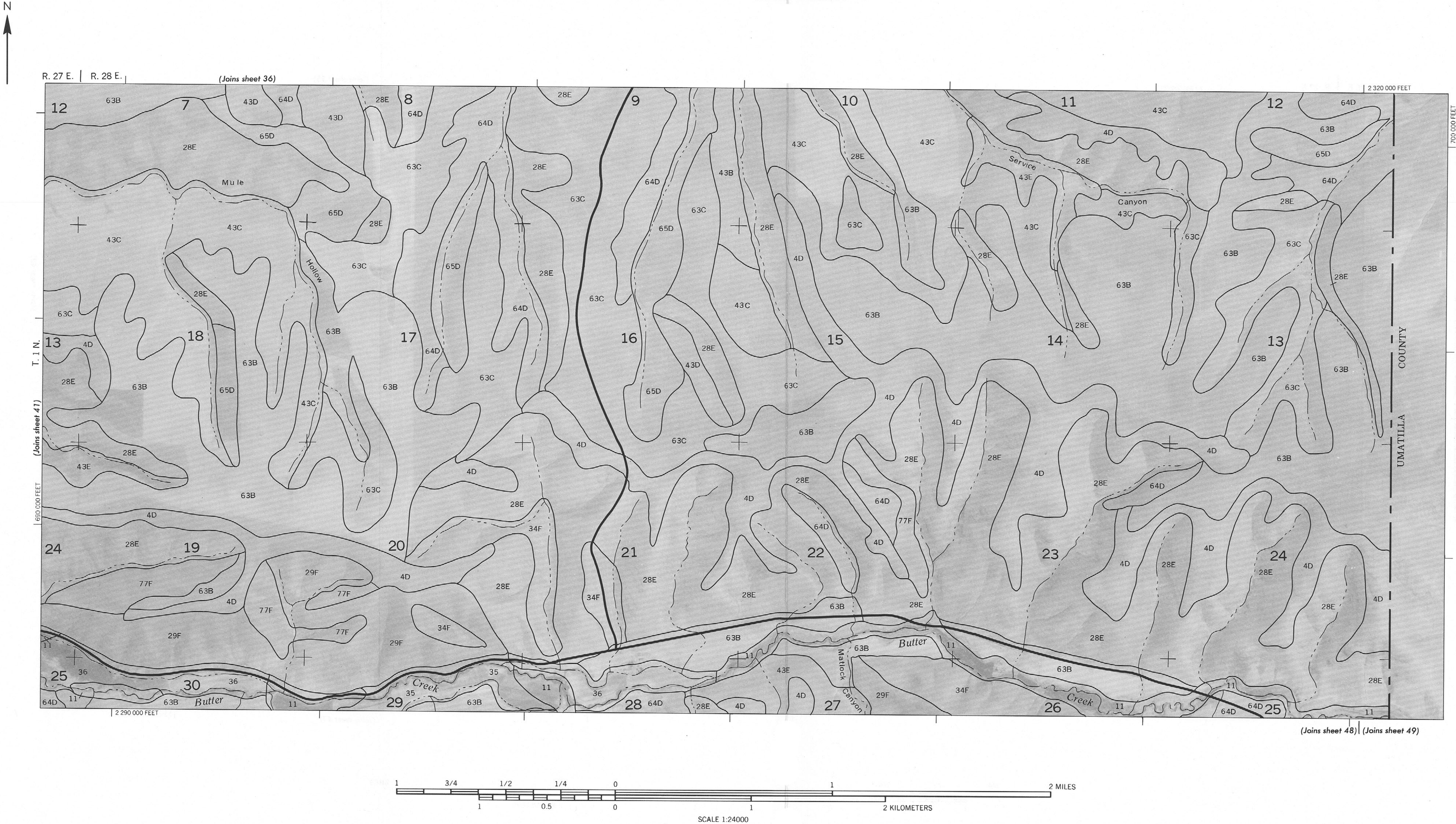
MORROW COUNTY, OREGON — SHEET NUMBER 41

MORROW COUNTY, OREGON NO. 41

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
R. 26 E.
R. 27 E.
T. 1 N.
2 260 000 FEET
2 285 000 FEET
700 000 FEET
690 000 FEET
(Joins sheet 35)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 47)
Carpenter Butte
Pine City
Galloway
Little Butter Creek
Butter Creek
SCALE 1:24000
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS

MORROW COUNTY, OREGON — SHEET NUMBER 42


N
R. 27 E.
R. 28 E.
(Joins sheet 36)
2 320 000 FEET
700 000 FEET
690 000 FEET
T. 1 N.
(Joins sheet 41)
2 290 000 FEET
(Joins sheet 48)
(Joins sheet 49)
UMATILLA COUNTY
Mule Hollow
Service Canyon
Butter Creek
Matlock Canyon
12
7
8
9
10
11
12
13
18
17
16
15
14
13
24
19
20
21
22
23
24
25
30
29
28
27
26
25
28E
43C
43D
43E
4D
63B
63C
64D
65D
77F
29F
34F
35
36
11
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

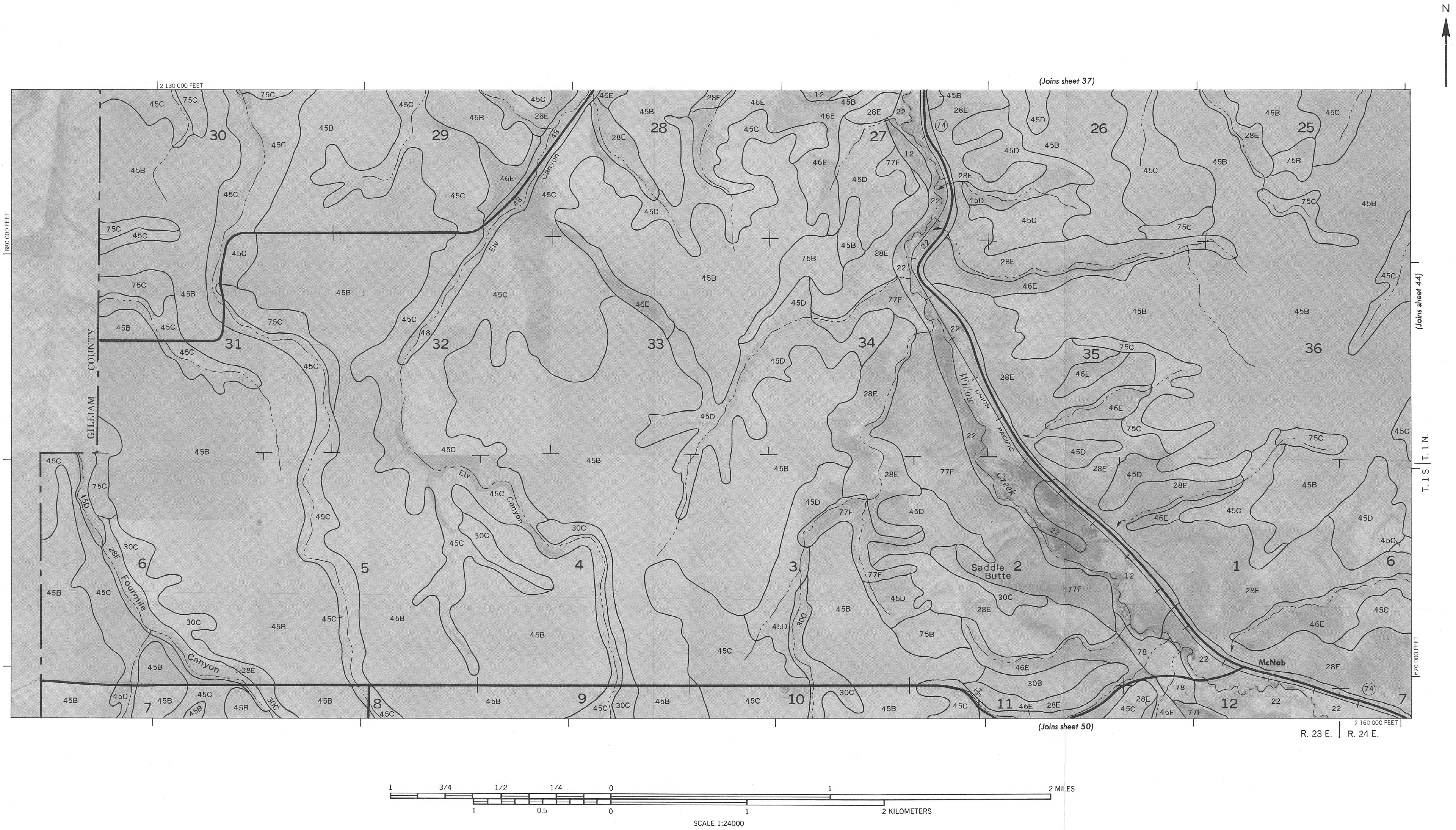
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

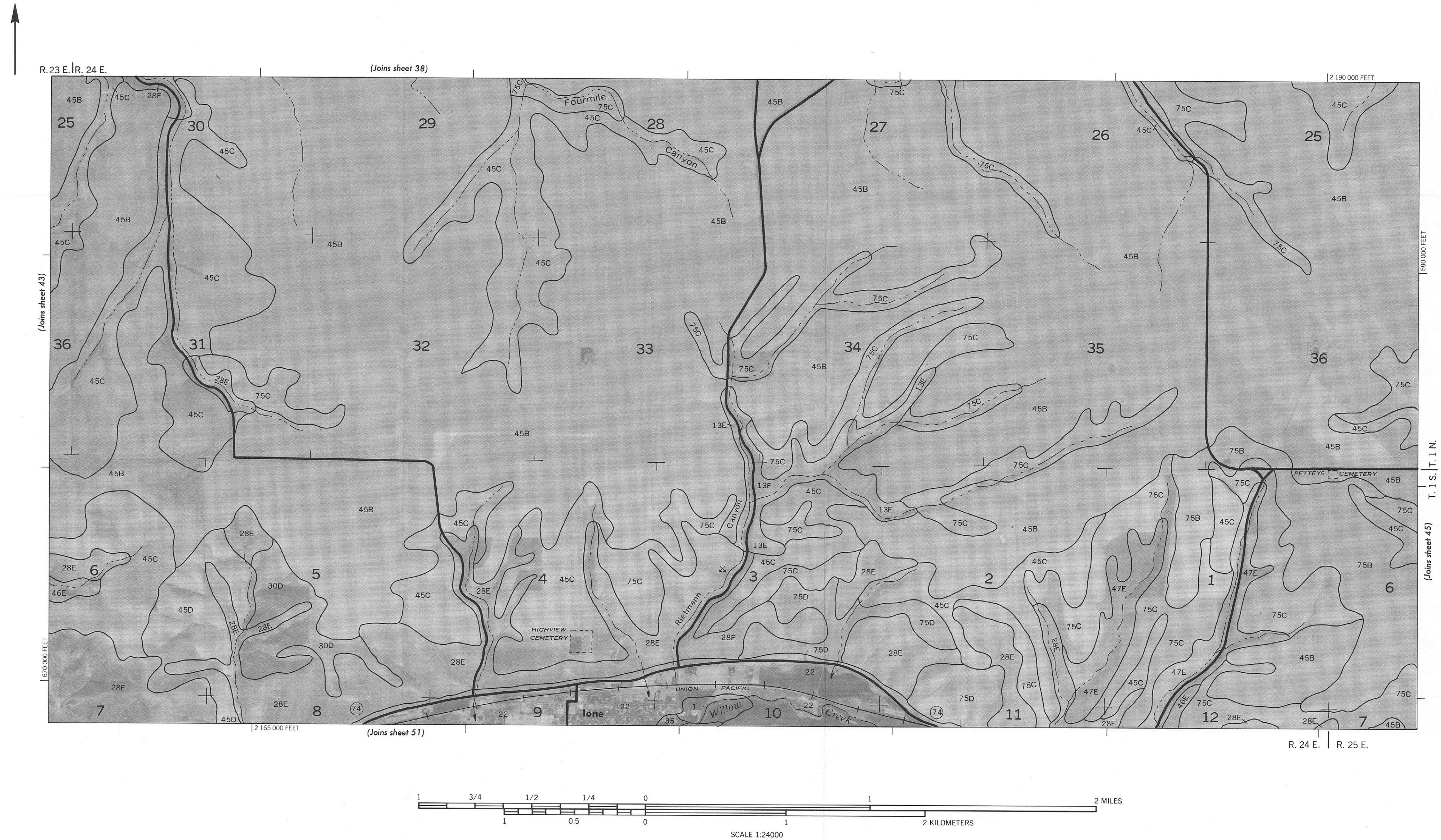
MORROW COUNTY, OREGON — SHEET NUMBER 43

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
(Joins sheet 37)
(Joins sheet 44)
(Joins sheet 50)
2 130 000 FEET
2 160 000 FEET
680 000 FEET
670 000 FEET
T. 1 N.
T. 1 S.
R. 23 E.
R. 24 E.
GILLIAM COUNTY
Ely Canyon
Fourmile Canyon
Willow Creek
UNION PACIFIC
Saddle Butte
McNab
74
48
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
7
8
9
10
11
12
45B
45C
45D
46E
28E
75B
75C
77F
22
12
30B
30C
78
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

㊹

MORROW COUNTY, OREGON — SHEET NUMBER 44


N
R.23 E. R. 24 E.
(Joins sheet 38)
2 190 000 FEET
680 000 FEET
(Joins sheet 43)
(Joins sheet 45)
670 000 FEET
2 165 000 FEET
(Joins sheet 51)
R. 24 E. R. 25 E.
T. 1 N.
T. 1 S.
25
30
29
28
27
26
25
36
31
32
33
34
35
36
6
5
4
3
2
1
6
7
8
9
10
11
12
7
Fourmile
Canyon
Rietmann
Canyon
Willow
Creek
UNION PACIFIC
Ione
HIGHVIEW CEMETERY
PETTEYS CEMETERY
74
45B
45C
28E
75C
75B
13E
45D
30D
46E
47E
75D
46E
22
1
35
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

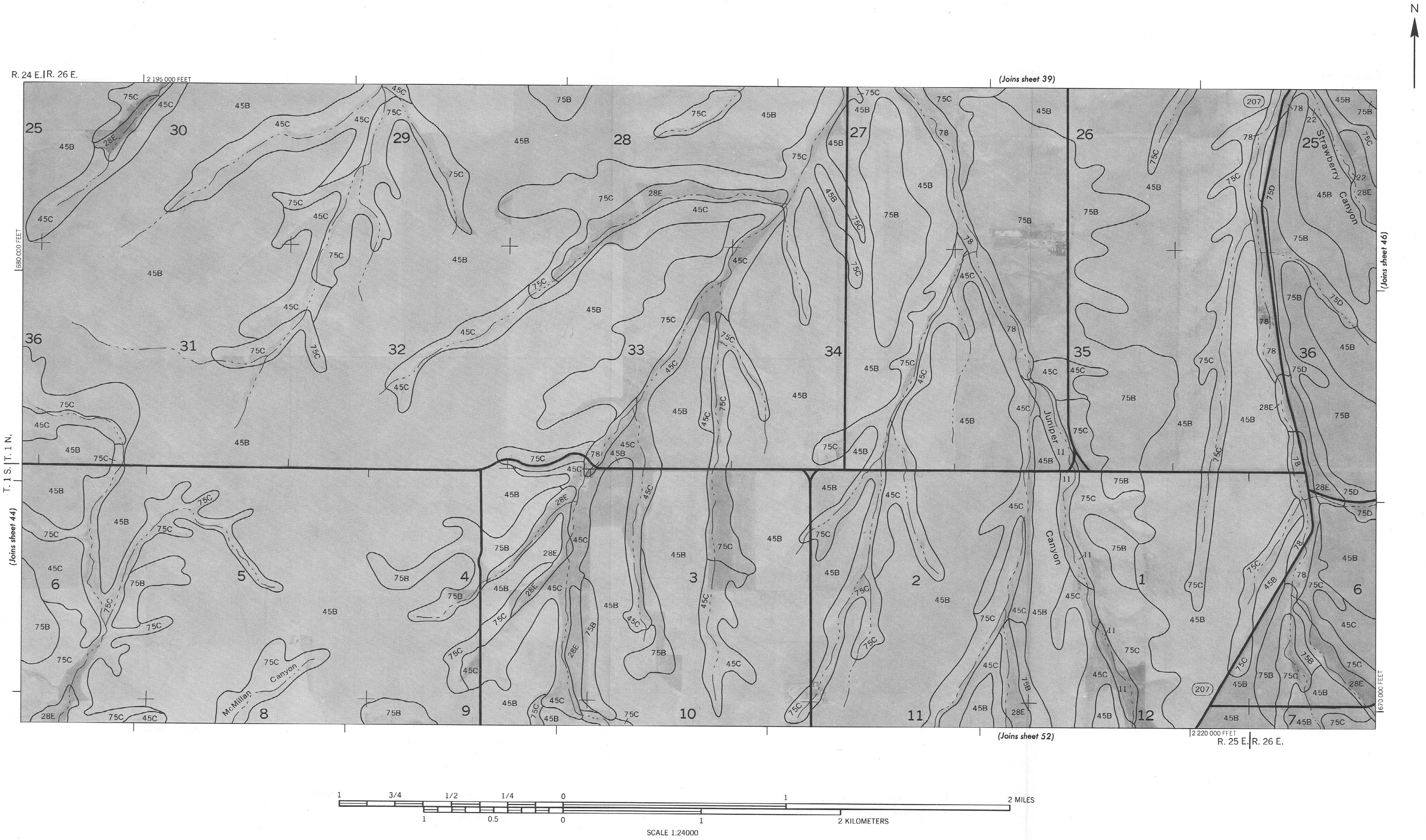
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 44

MORROW COUNTY, OREGON — SHEET NUMBER 45

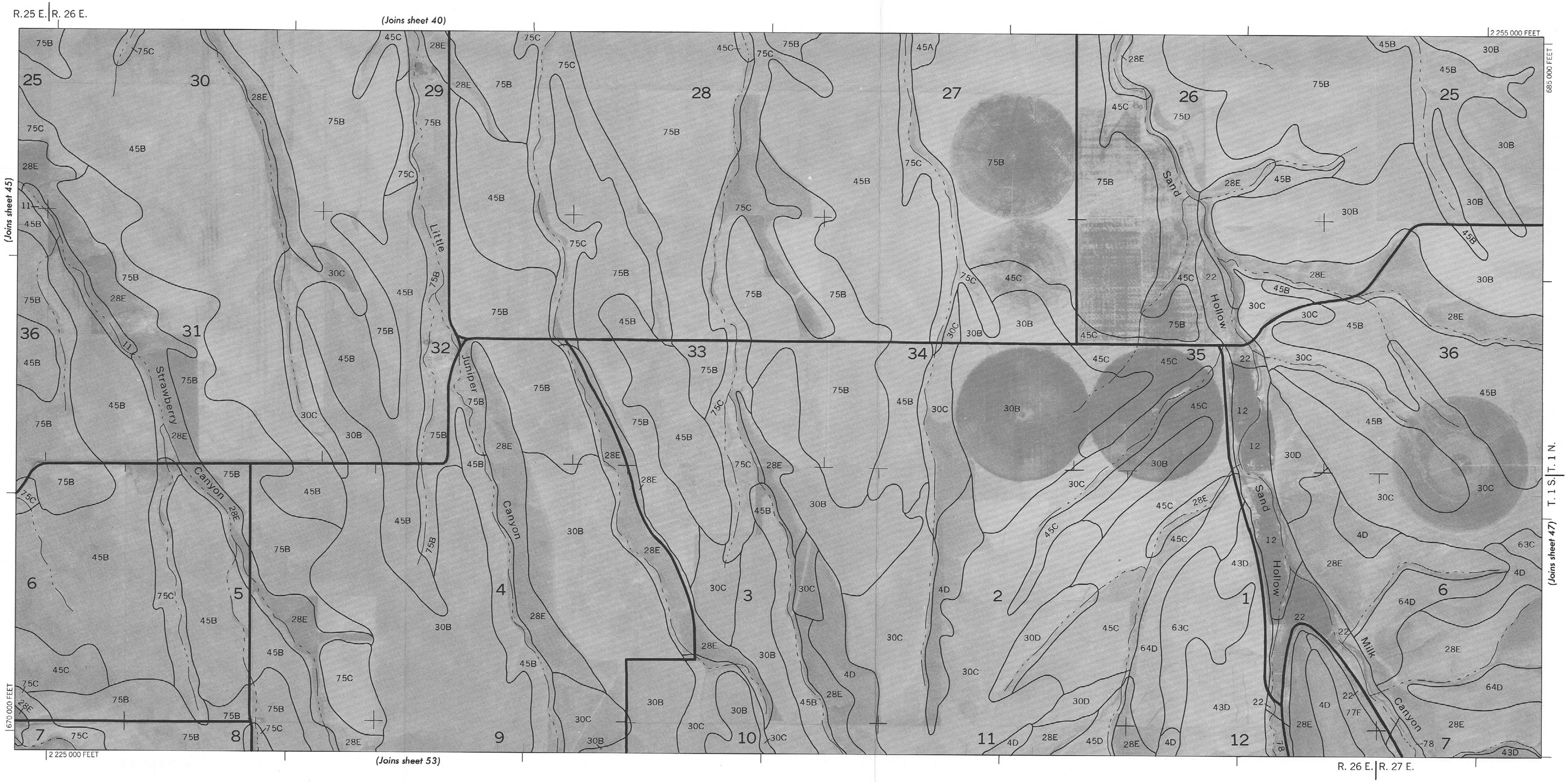
MORROW COUNTY, OREGON NO. 45

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
R. 24 E. | R. 26 E.
2 195 000 FEET
(Joins sheet 39)
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 52)
680 000 FEET
670 000 FEET
2 220 000 FEET
R. 25 E. | R. 26 E.
T. 1 N.
T. 1 S.
25
30
29
28
27
26
25
36
31
32
33
34
35
36
6
5
4
3
2
1
6
8
9
10
11
12
7
Strawberry Canyon
Juniper Canyon
McMillan Canyon
207
45B
45C
75B
75C
75D
28E
78
22
11
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 46

N



R.25 E.
R. 26 E.
(Joins sheet 40)
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 53)
2 255 000 FEET
685 000 FEET
670 000 FEET
2 225 000 FEET
T. 1 S.
T. 1 N.
R. 26 E.
R. 27 E.
25
30
29
28
27
26
25
36
31
32
33
34
35
36
6
5
4
3
2
1
6
7
8
9
10
11
12
7
Little
Strawberry
Canyon
Juniper
Canyon
Sand
Hollow
Sand
Hollow
Milk
Canyon
75B
75C
45B
45C
45A
28E
30B
30C
30D
11
12
22
4D
43D
63C
64D
77F
78
75D

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

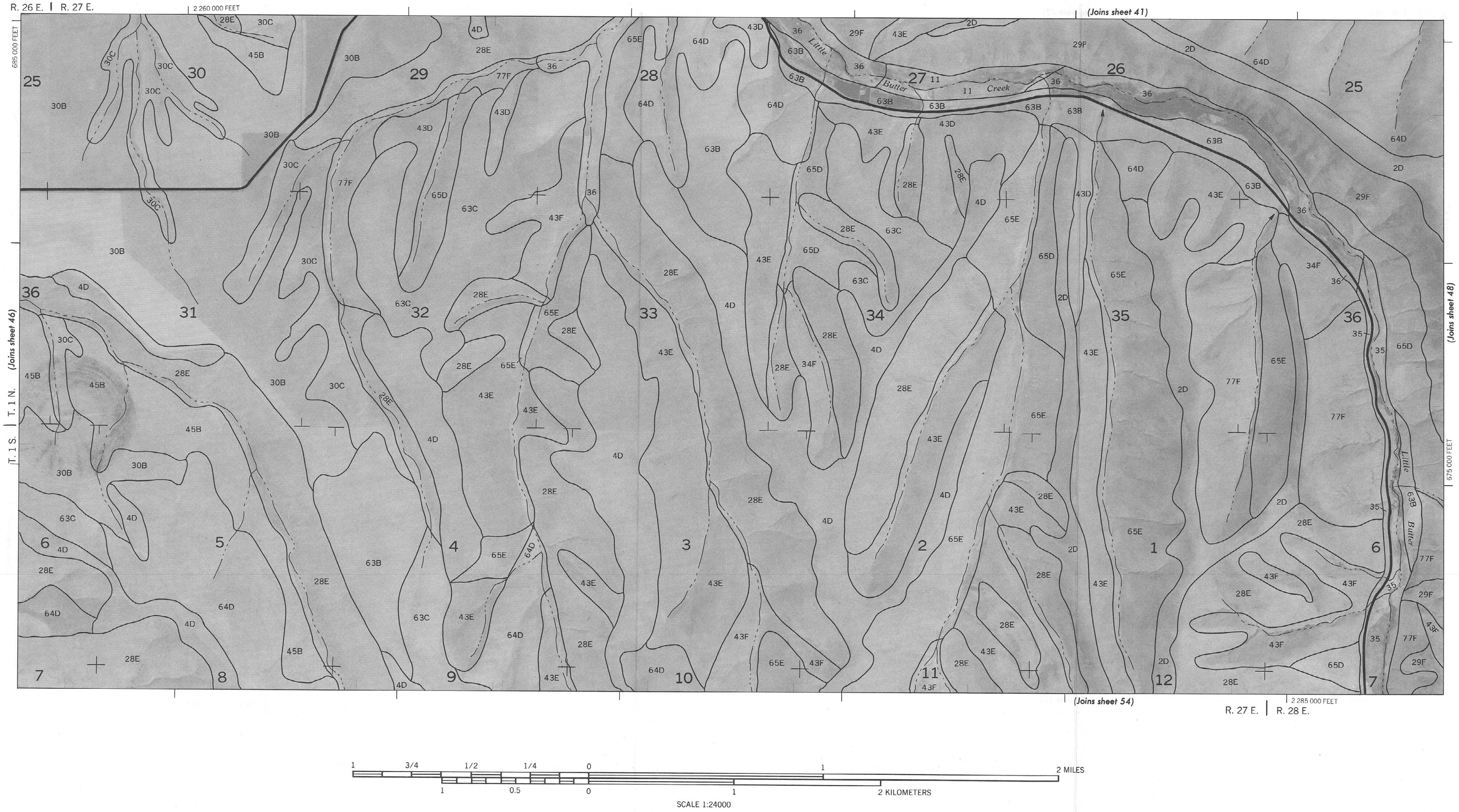
Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 46

MORROW COUNTY, OREGON — SHEET NUMBER 47

MORROW COUNTY, OREGON NO. 47

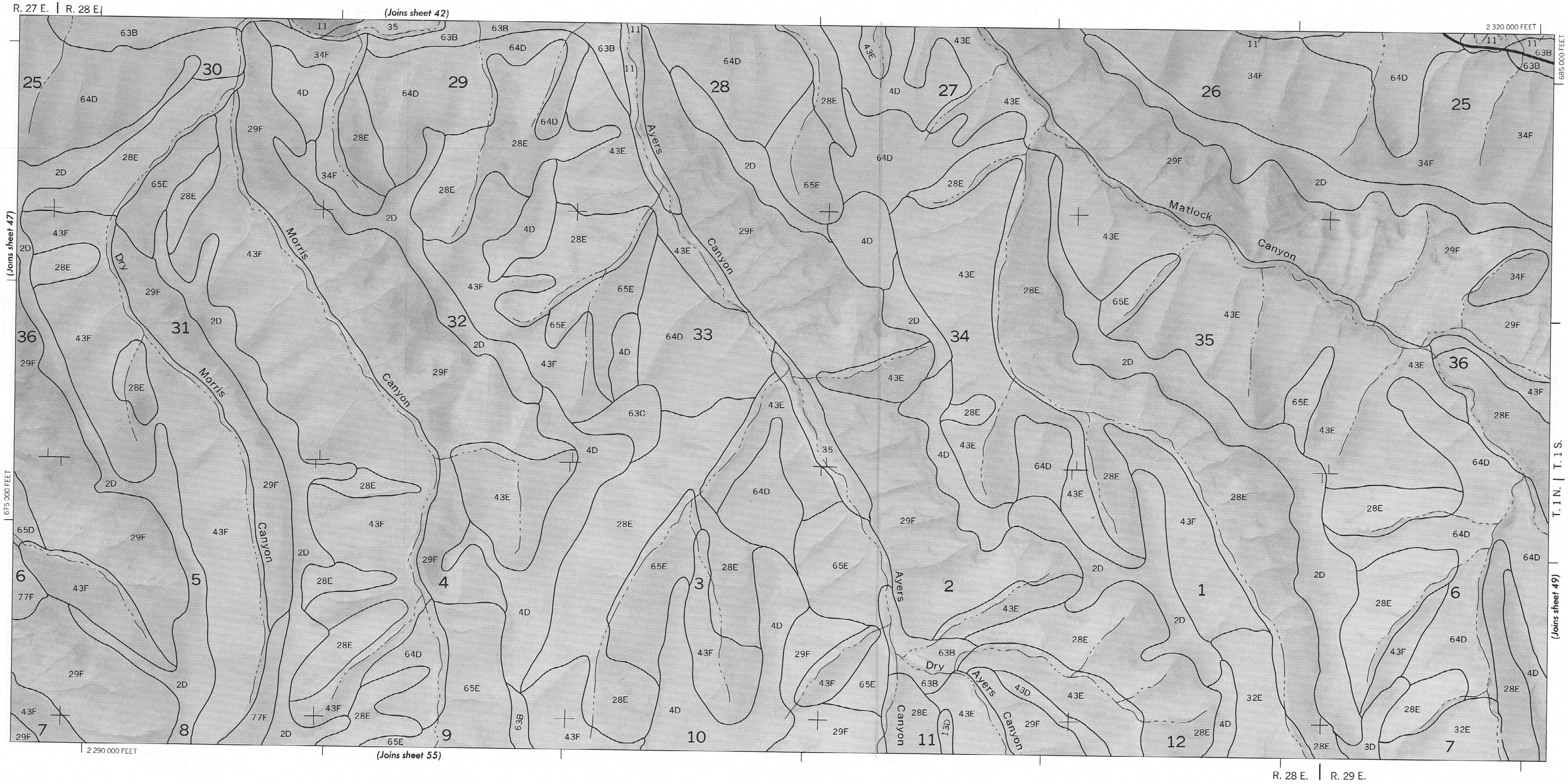
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

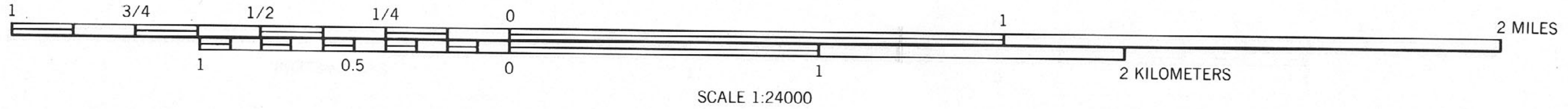

N
R. 26 E. | R. 27 E.
2 260 000 FEET
685 000 FEET
(Joins sheet 41)
(Joins sheet 46)
(Joins sheet 48)
(Joins sheet 54)
675 000 FEET
2 285 000 FEET
R. 27 E. | R. 28 E.
T. 1 N.
T. 1 S.
Little Butter Creek
25
30
29
28
27
26
36
31
32
33
34
35
6
5
4
3
2
1
7
8
9
10
11
12
30B
30C
28E
45B
4D
77F
43D
65E
64D
36
63B
29F
43E
2D
11
65D
63C
43F
34F
35
65E
77F
28E
1
3/4
1/2
1/4
0
2 MILES
0.5
2 KILOMETERS

SCALE 1:24000

N

MORROW COUNTY, OREGON — SHEET NUMBER 48


R. 27 E. | R. 28 E.
(Joins sheet 42)
2 320 000 FEET
685 000 FEET
(Joins sheet 47)
675 000 FEET
(Joins sheet 49)
T. 1 N. | T. 1 S.
2 290 000 FEET
(Joins sheet 55)
R. 28 E. | R. 29 E.
Morris Canyon
Dry Morris Canyon
Ayers Canyon
Matlock Canyon
Dry Ayers Canyon
25
30
29
28
27
26
25
36
31
32
33
34
35
36
6
5
4
3
2
1
6
7
8
9
10
11
12
7


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

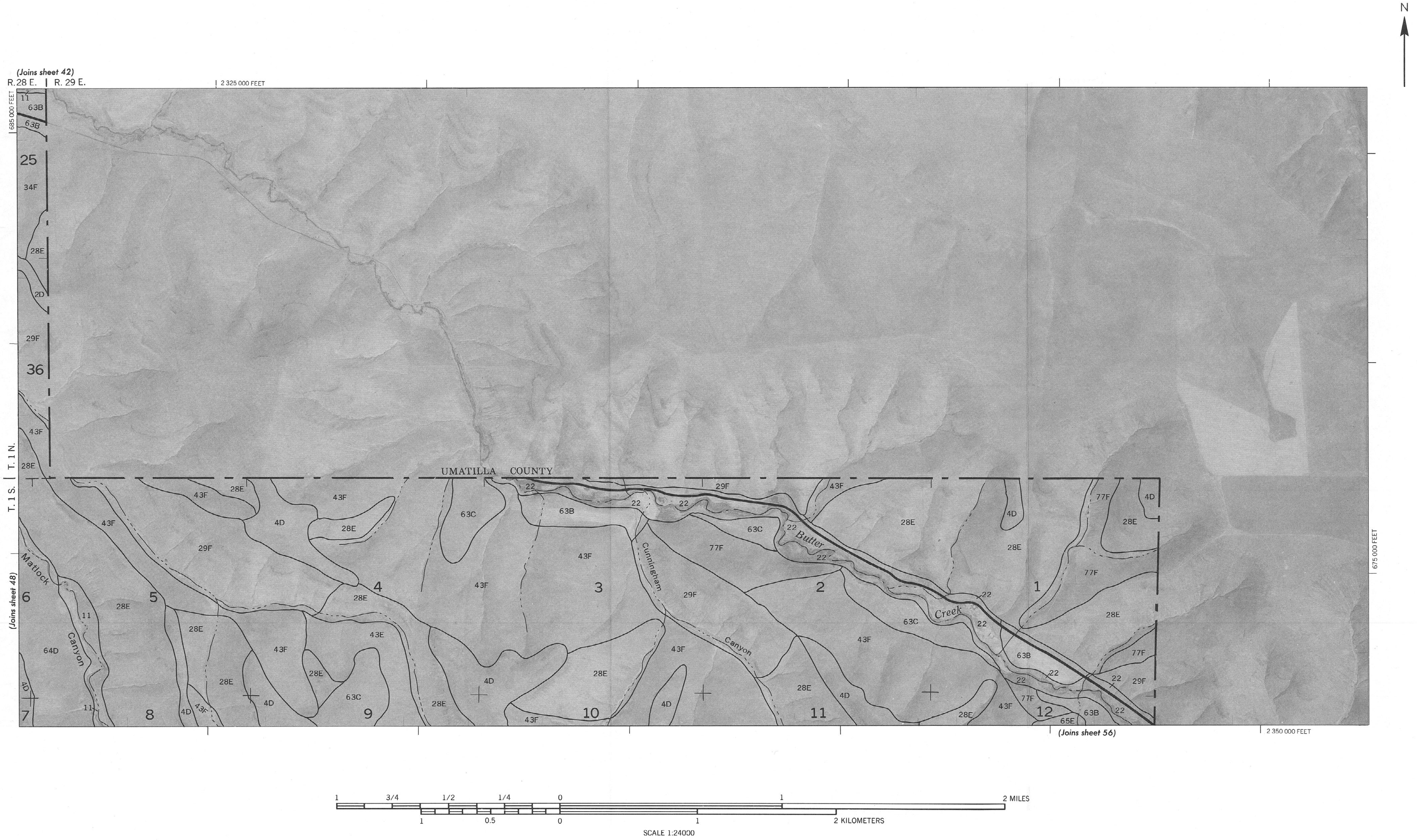
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 48

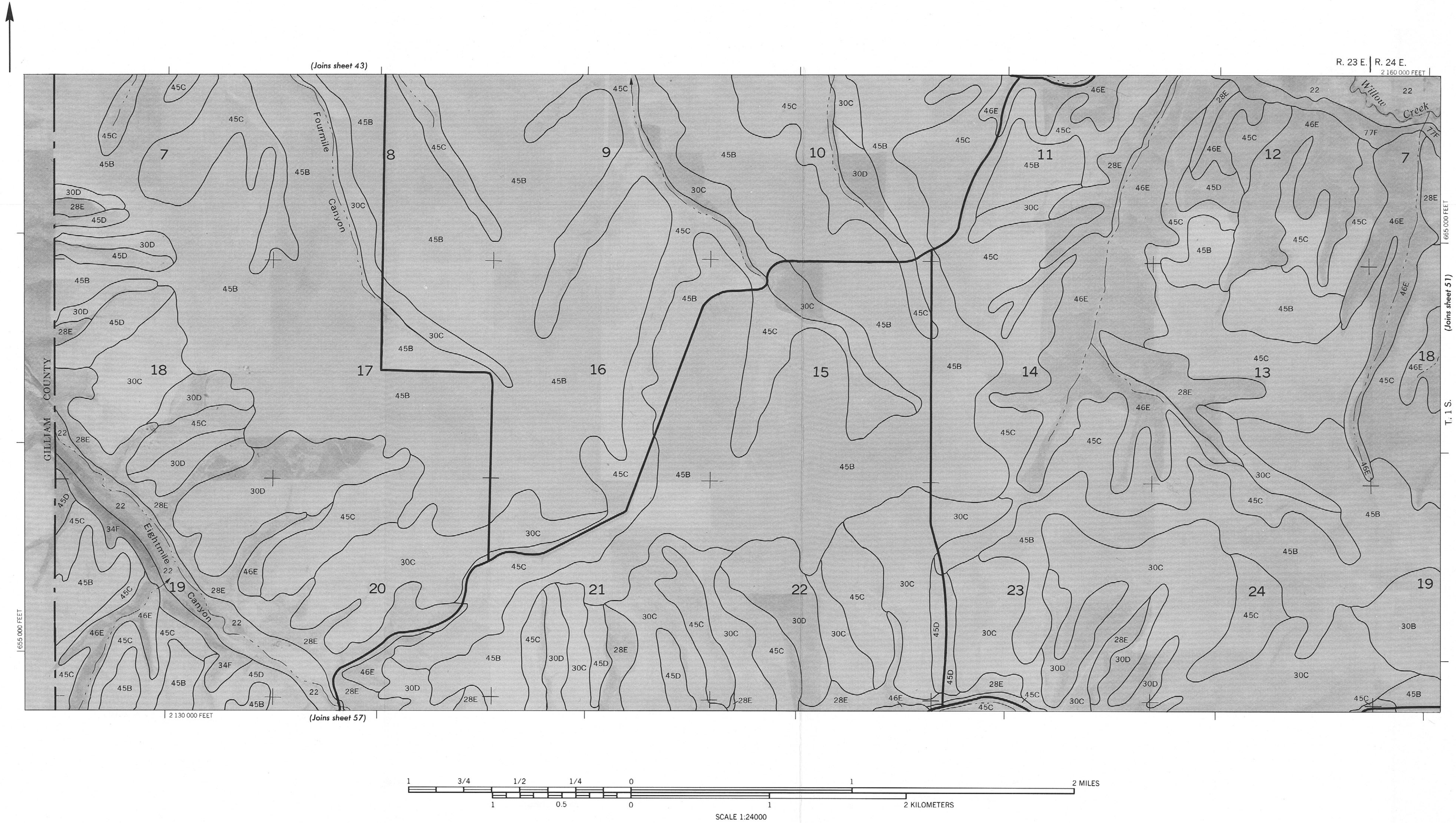
MORROW COUNTY, OREGON NO. 49

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
(Joins sheet 42)
R.28 E.
R. 29 E.
2 325 000 FEET
685 000 FEET
11
63B
25
34F
28E
2D
29F
36
43F
T. 1 N.
T. 1 S.
UMATILLA COUNTY
22
29F
63B
43F
28E
4D
63C
77F
Butter
Creek
Cunningham
Canyon
Matlock
Canyon
(Joins sheet 48)
6
5
4
3
2
1
64D
28E
43E
7
8
9
10
11
12
65E
675 000 FEET
(Joins sheet 56)
2 350 000 FEET
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

㊿

MORROW COUNTY, OREGON — SHEET NUMBER 50


N
(Joins sheet 43)
(Joins sheet 57)
(Joins sheet 51)
R. 23 E. | R. 24 E.
T. 1 S.
2 160 000 FEET
2 130 000 FEET
655 000 FEET
665 000 FEET
GILLIAM COUNTY
Fourmile Canyon
Eightmile Canyon
Willow Creek
7
8
9
10
11
12
7
18
17
16
15
14
13
18
19
20
21
22
23
24
19
45C
45B
45D
30C
30D
30B
28E
46E
34F
22
77F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

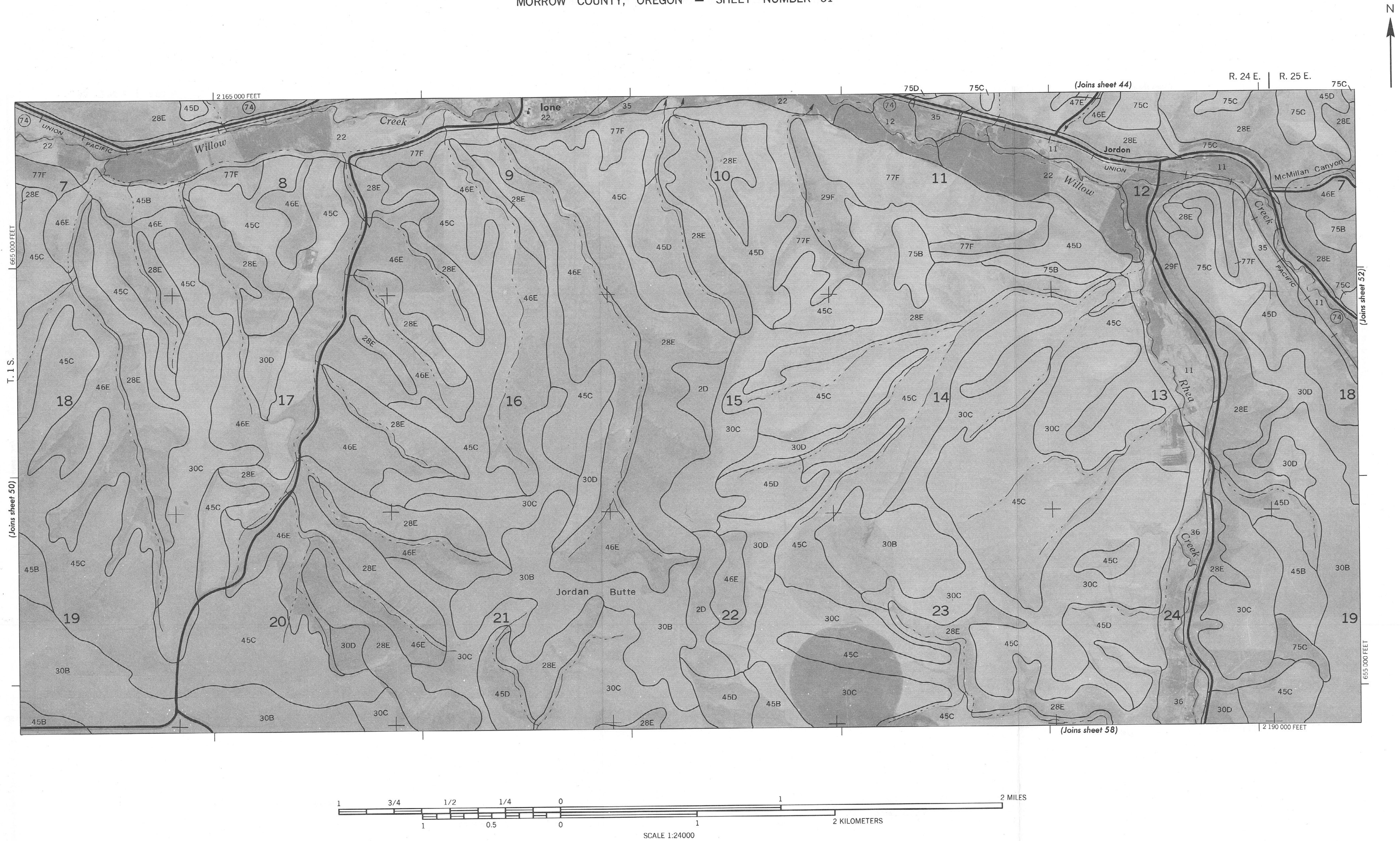
Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 50

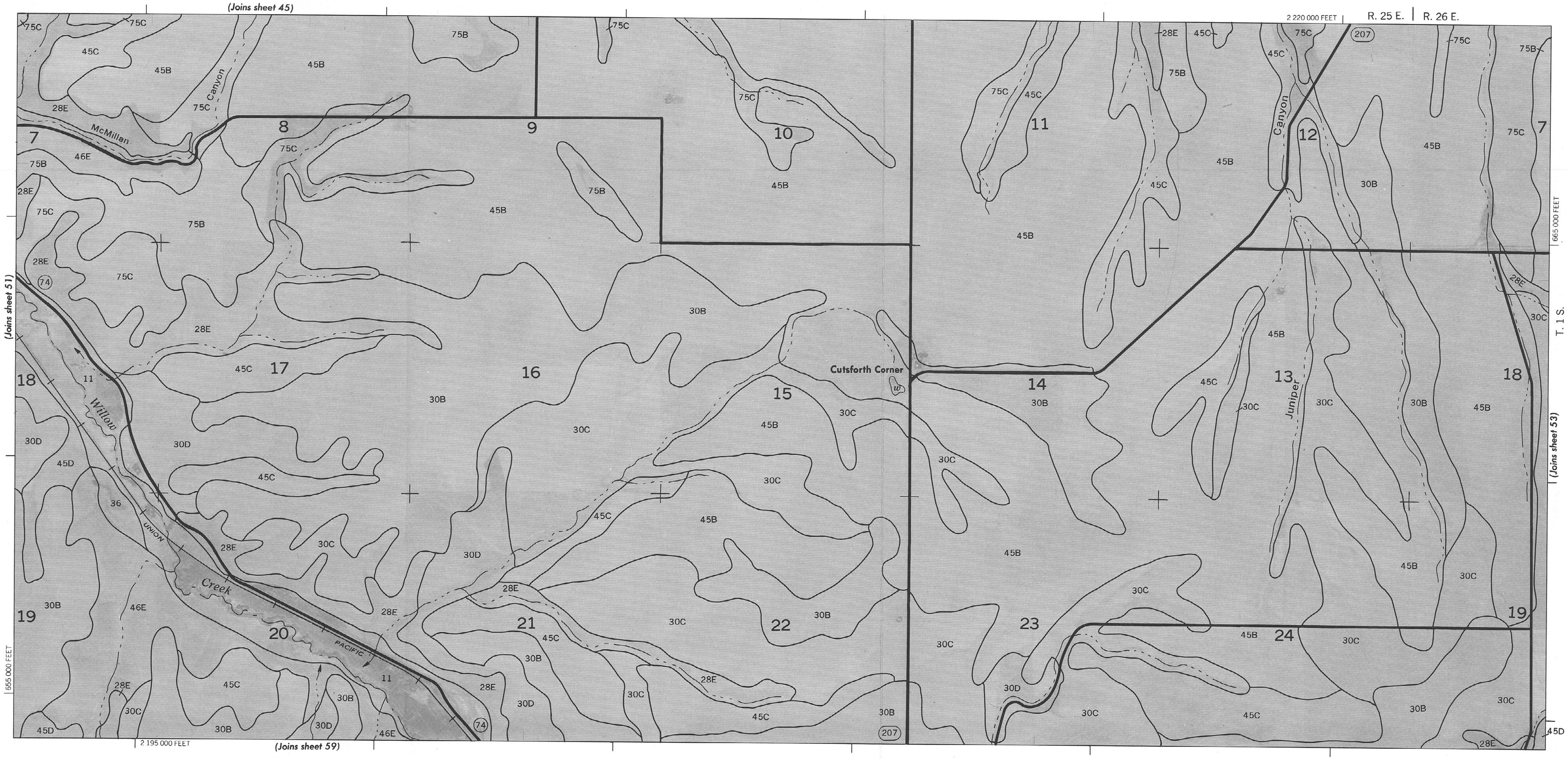
MORROW COUNTY, OREGON — SHEET NUMBER 51

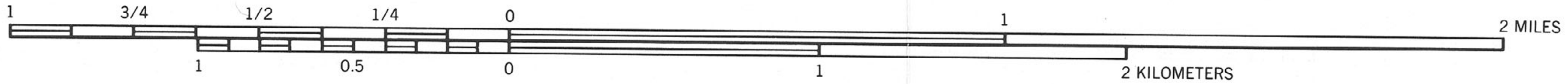
MORROW COUNTY, OREGON NO. 51

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
R. 24 E.
R. 25 E.
T. 1 S.
(Joins sheet 44)
(Joins sheet 50)
(Joins sheet 52)
(Joins sheet 58)
2 165 000 FEET
2 190 000 FEET
665 000 FEET
655 000 FEET
Ione
Jordon
Jordan Butte
Willow Creek
Rhea Creek
McMillan Canyon
UNION PACIFIC
74
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
2D
11
12
22
28E
29F
30B
30C
30D
35
36
45B
45C
45D
46E
47E
75B
75C
75D
77F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 52


(Joins sheet 45)
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 59)
2 220 000 FEET
2 195 000 FEET
665 000 FEET
655 000 FEET
R. 25 E.
R. 26 E.
T. 1 S.
7
8
9
10
11
12
7
18
17
16
15
14
13
18
19
20
21
22
23
24
19
McMillan
Canyon
Canyon
Willow
Creek
UNION
PACIFIC
Juniper
Cutsforth Corner
W
74
74
207
207
75C
75C
45C
45B
45B
75B
28E
75C
75C
75B
46E
28E
75C
75B
28E
75C
75B
45B
30B
28E
45C
30B
11
30D
45D
30D
45C
30C
36
28E
30C
30D
45C
30B
46E
30B
28E
30C
45D
45C
30B
30D
46E
11
28E
30D
28E
21
45C
30B
28E
30C
45B
30C
45B
30C
45B
30C
30B
45C
30B
75C
45B
28E
45C
75B
75C
45C
45B
45C
45B
45C
30B
45B
30C
30C
45B
30C
30C
30D
30C
45B
45C
30C
30C
30B
45B
30C
45B
30C
30B
75C
75B
28E
30C
45D
28E


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

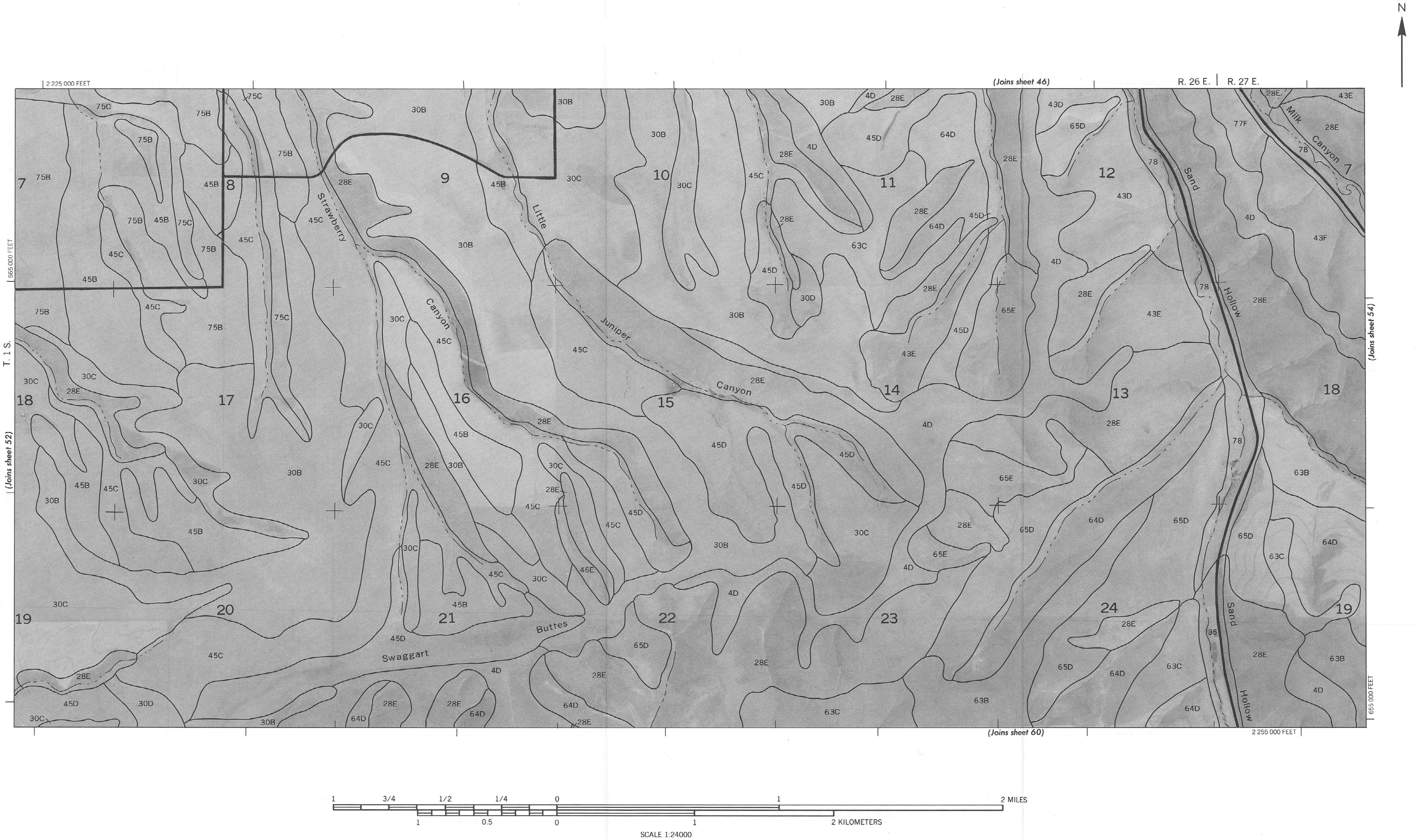
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 52

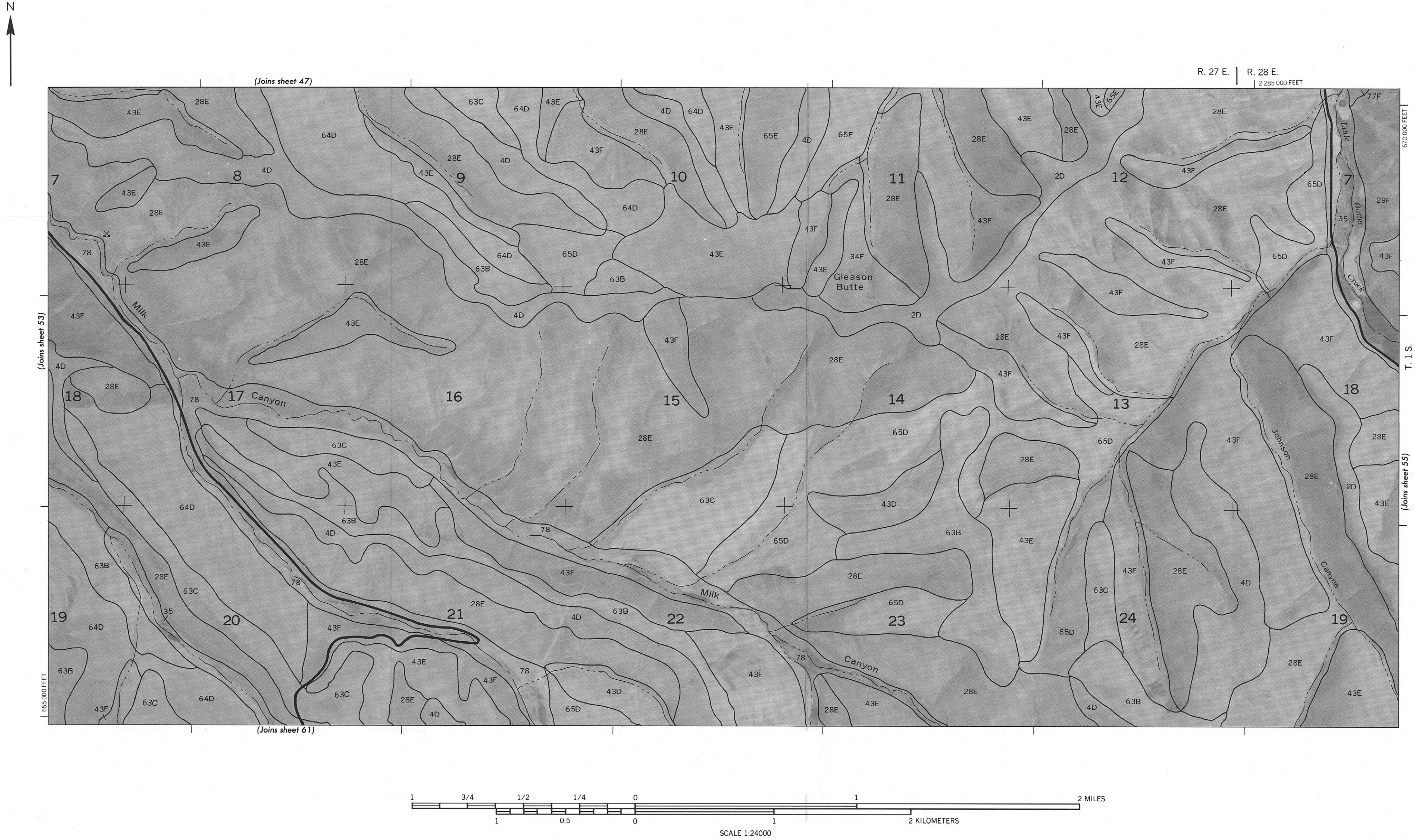
MORROW COUNTY, OREGON — SHEET NUMBER 53

MORROW COUNTY, OREGON NO. 53

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
2 225 000 FEET
(Joins sheet 46)
R. 26 E.
R. 27 E.
665 000 FEET
T. 1 S.
(Joins sheet 52)
(Joins sheet 54)
(Joins sheet 60)
2 255 000 FEET
655 000 FEET
Strawberry Canyon
Little Juniper Canyon
Sand Hollow
Milk Canyon
Swaggart Buttes
7
8
9
10
11
12
7
18
17
16
15
14
13
18
19
20
21
22
23
24
19
75C
75B
45B
45C
30B
30C
28E
4D
45D
64D
43D
65D
43E
77F
78
43F
63C
30D
65E
63B
46E
35
28E
64D
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 54

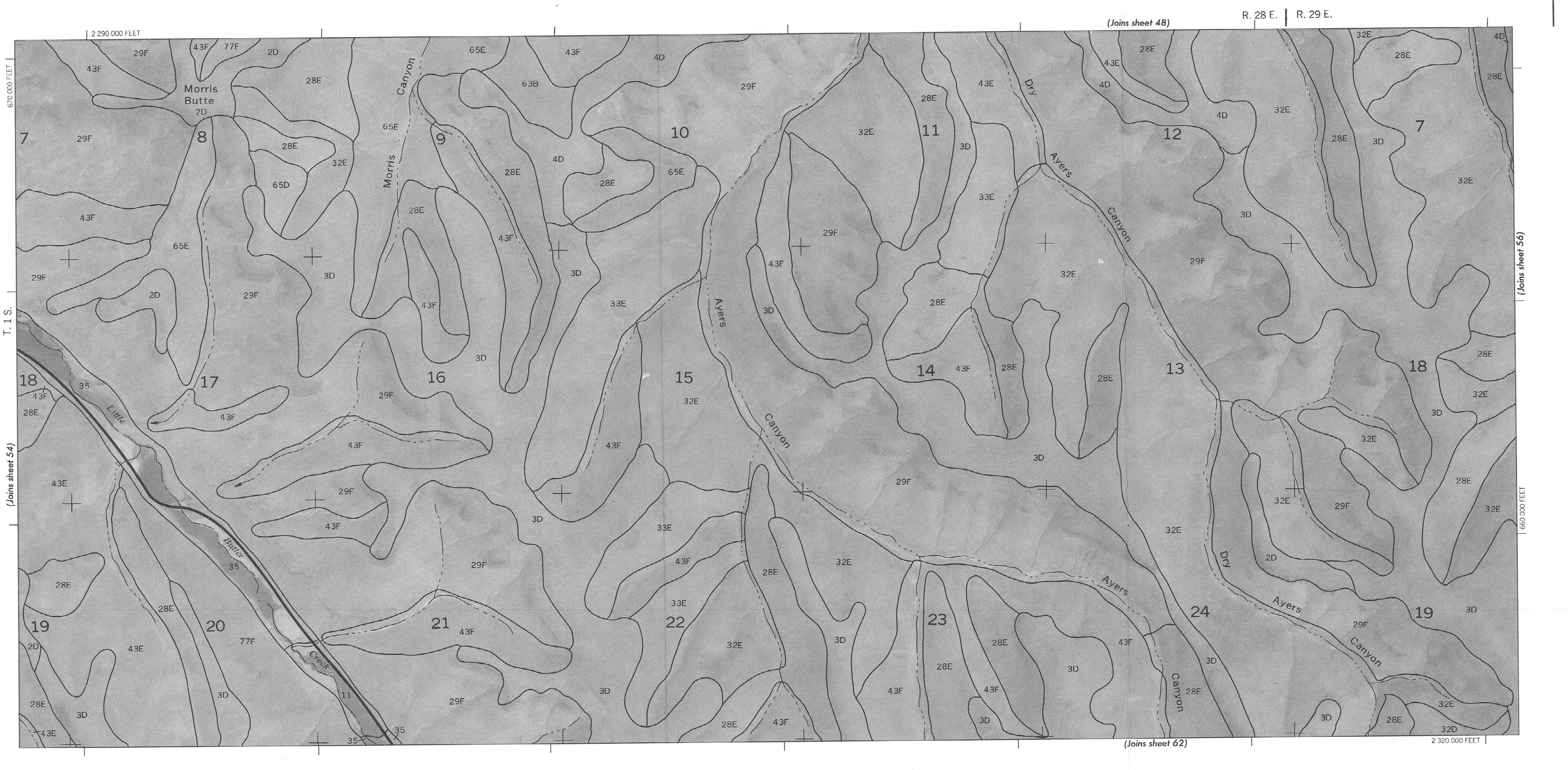

N
(Joins sheet 47)
R. 27 E.
R. 28 E.
2 285 000 FEET
670 000 FEET
655 000 FEET
(Joins sheet 53)
(Joins sheet 55)
(Joins sheet 61)
T. 1 S.
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Milk
Canyon
Milk
Canyon
Gleason
Butte
Little
Butter
Creek
Johnson
Canyon
43E
28E
64D
63C
64D
43E
4D
64D
43F
65E
4D
65E
28E
43E
43E
65E
28E
28E
77F
43E
4D
43E
28E
4D
28E
43F
43F
2D
43F
65D
29F
43E
28E
64D
28E
43F
43E
28E
35
43F
78
43E
28E
64D
65D
43E
34F
43E
63B
63B
43F
65D
43F
28E
43E
4D
43F
2D
28E
43F
28E
43F
43F
43E
28E
4D
28E
78
17
16
15
14
13
18
63C
28E
65D
28E
65D
43F
28E
43E
2D
43E
64D
63C
63B
43D
63B
4D
78
65D
43E
43F
28E
4D
63B
28E
35
63C
78
43F
28E
4D
63B
63C
28E
65D
65D
4D
64D
63B
43F
63C
43E
43F
78
43E
78
43E
28E
43E
28E
63C
28E
4D
43D
65D
28E
43E
4D
63B
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON — SHEET NUMBER 55

MORROW COUNTY, OREGON NO. 55

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

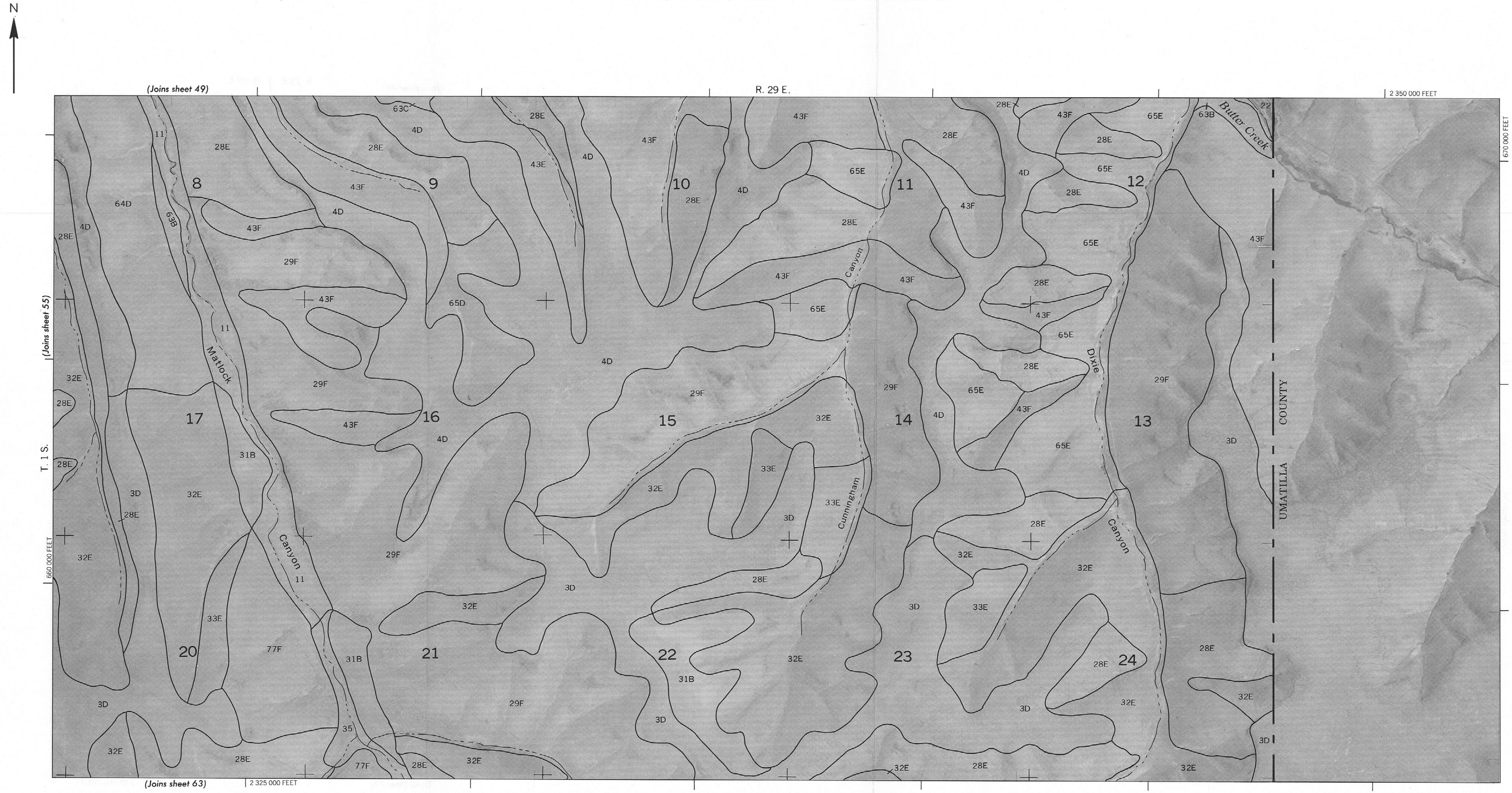

N
R. 28 E.
R. 29 E.
T. 1 S.
(Joins sheet 48)
(Joins sheet 54)
(Joins sheet 56)
(Joins sheet 62)
2 290 000 FEET
2 320 000 FEET
670 000 FEET
660 000 FEET
Morris Butte
Morris Canyon
Ayers Canyon
Dry Ayers Canyon
Little Butter Creek
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
2D
3D
4D
28E
29F
32E
32D
33E
35
43E
43F
63B
65D
65E
77F
11

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 56


N
(Joins sheet 49)
R. 29 E.
2 350 000 FEET
670 000 FEET
(Joins sheet 55)
T. 1 S.
660 000 FEET
(Joins sheet 63)
2 325 000 FEET
Butter Creek
Matlock
Canyon
Cunningham
Dixie
UMATILLA COUNTY
8
9
10
11
12
13
14
15
16
17
20
21
22
23
24
11
28E
63C
4D
43F
43E
65E
65D
64D
63B
29F
32E
3D
31B
33E
77F
35
22

1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

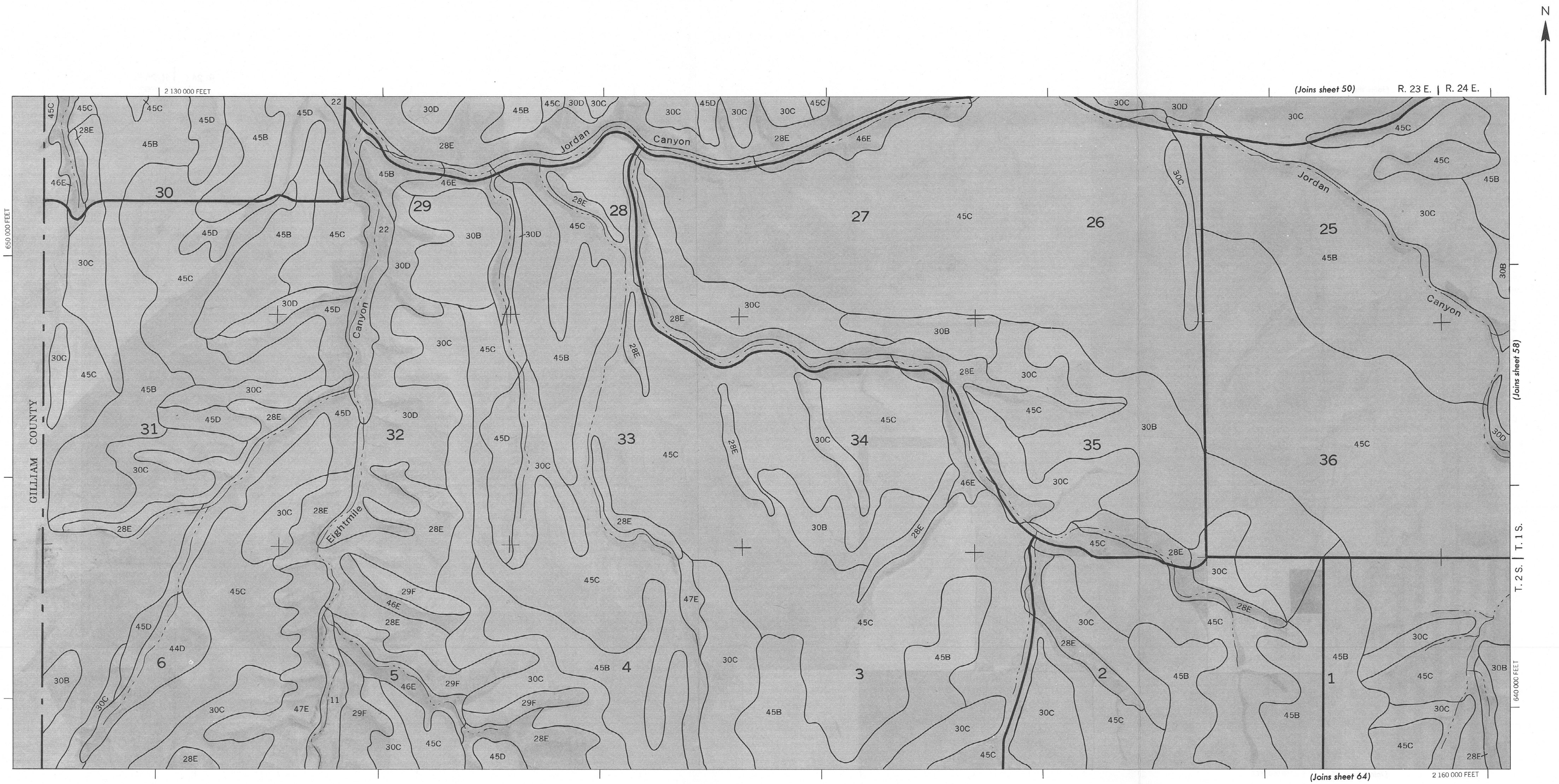
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

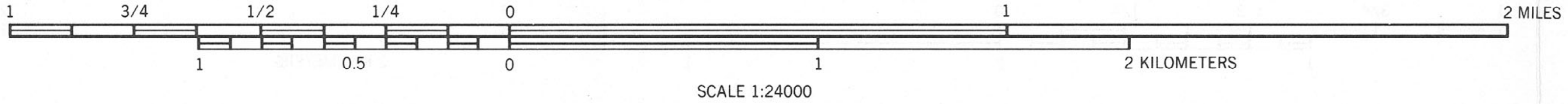
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON — SHEET NUMBER 57

MORROW COUNTY, OREGON NO. 57

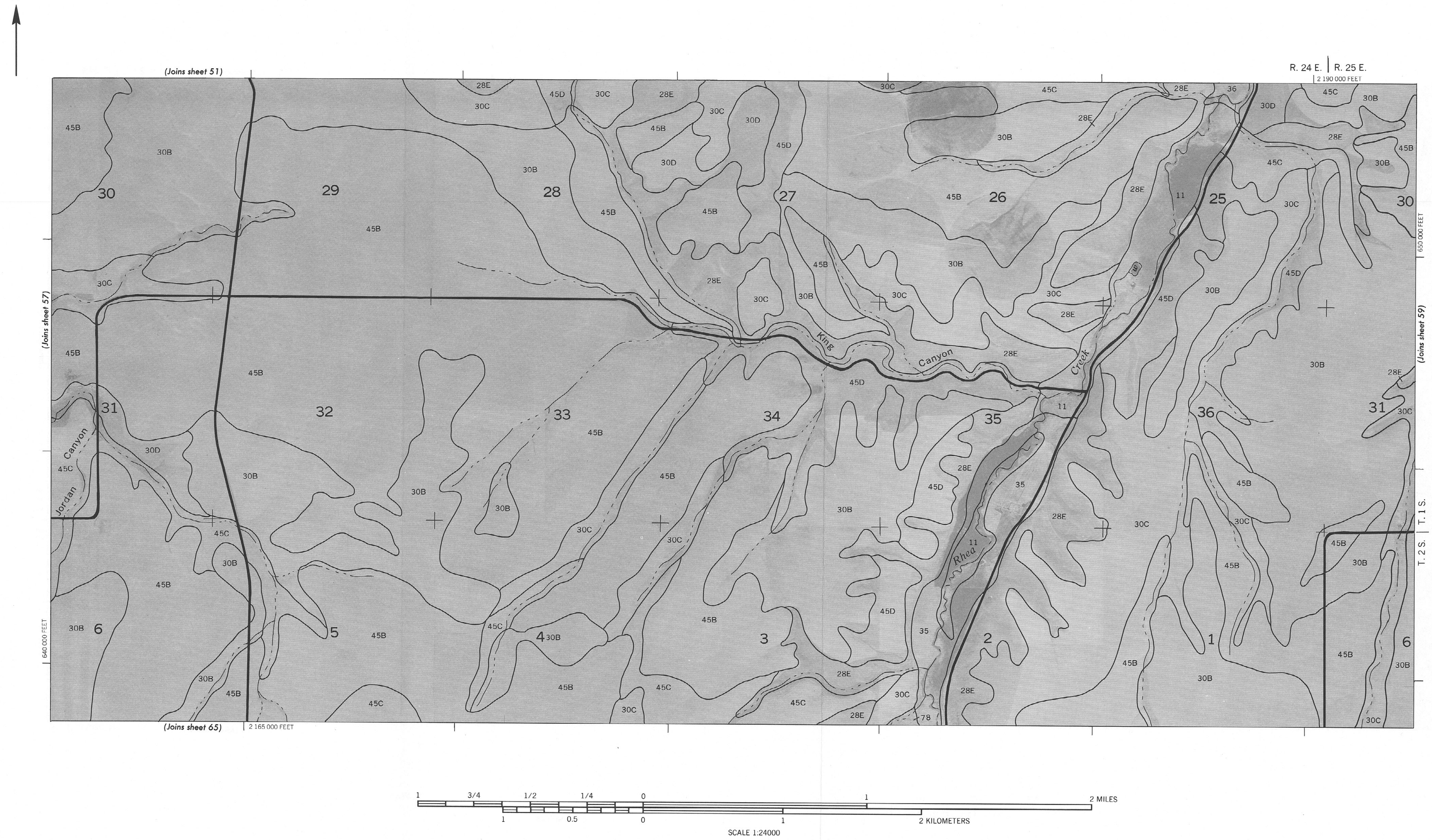
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
(Joins sheet 50)
R. 23 E.
R. 24 E.
2 130 000 FEET
650 000 FEET
640 000 FEET
2 160 000 FEET
(Joins sheet 58)
(Joins sheet 64)
T. 1 S.
T. 2 S.
GILLIAM COUNTY
Jordan Canyon
Eightmile Canyon
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
45C
45B
45D
30B
30C
30D
28E
46E
22
11
29F
47E
44D


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 58


N
(Joins sheet 51)
R. 24 E.
R. 25 E.
2 190 000 FEET
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 65)
2 165 000 FEET
650 000 FEET
640 000 FEET
T. 1 S.
T. 2 S.
30
29
28
27
26
25
30
31
32
33
34
35
36
31
6
5
4
3
2
1
6
King
Canyon
Creek
Rhea
Jordan
Canyon
45B
30B
30C
30D
28E
45C
45D
11
35
78
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

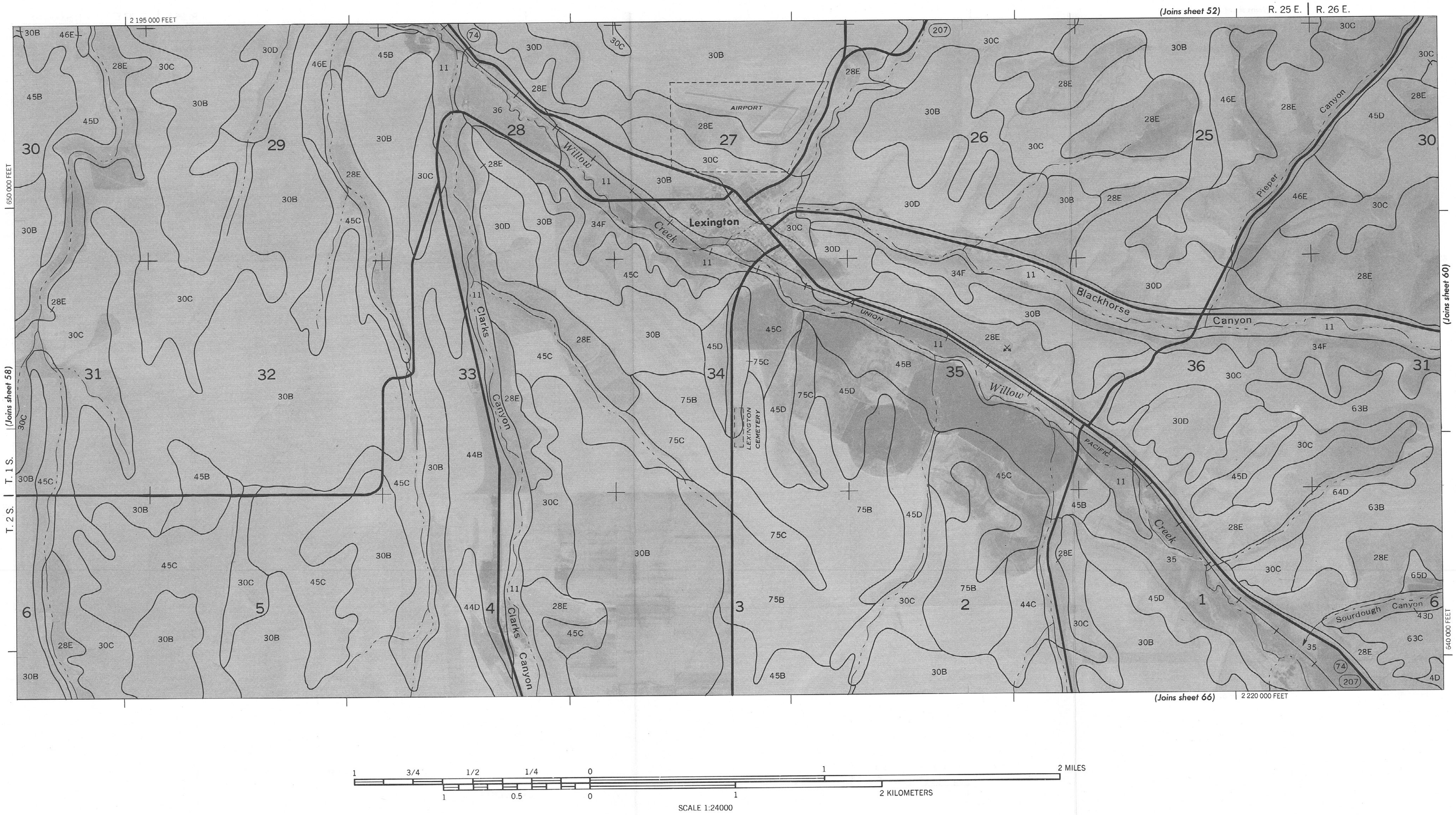
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 58

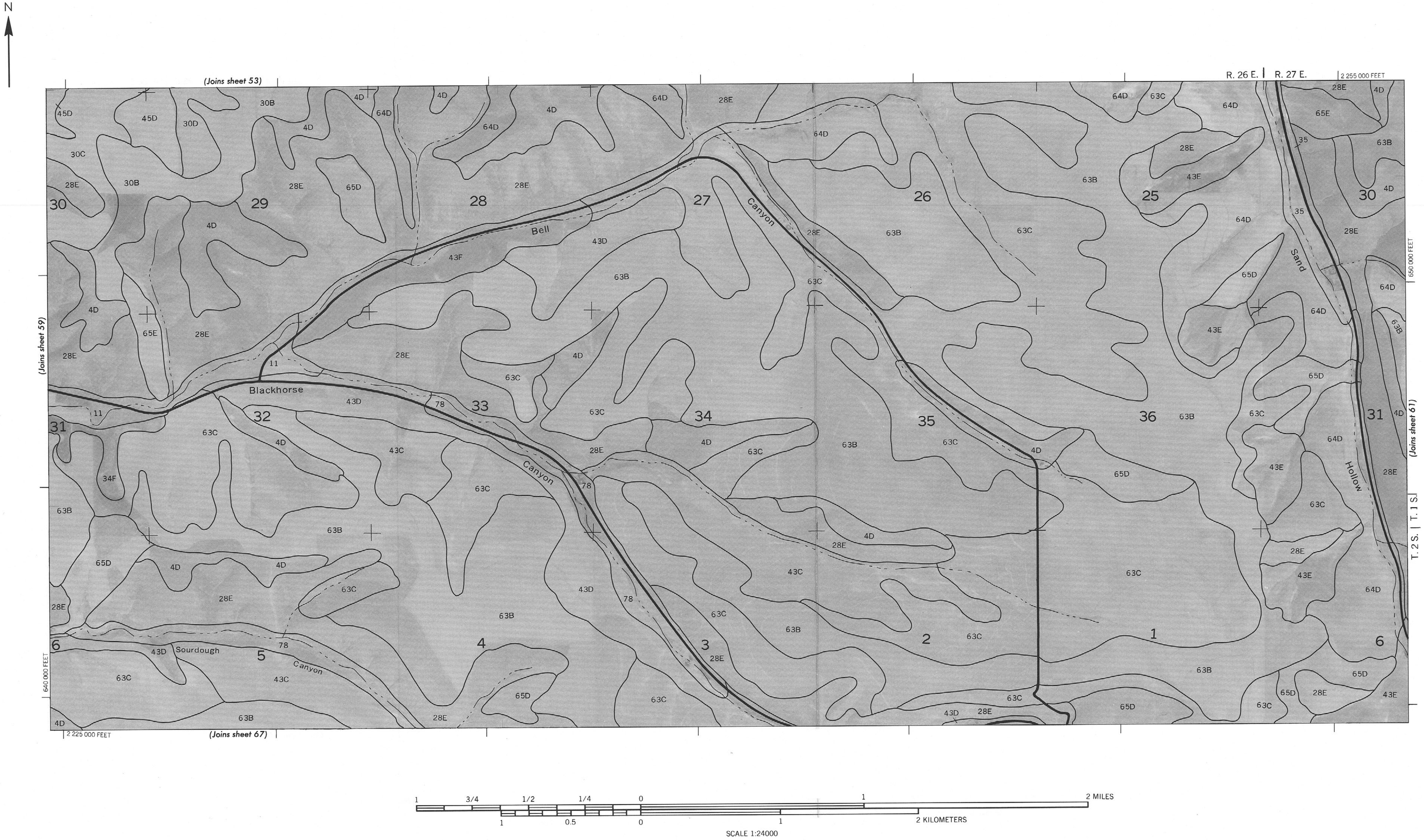
MORROW COUNTY, OREGON — SHEET NUMBER 59


N
(Joins sheet 52)
R. 25 E. | R. 26 E.
2 195 000 FEET
650 000 FEET
(Joins sheet 58)
(Joins sheet 60)
(Joins sheet 66)
2 220 000 FEET
640 000 FEET
T. 1 S.
T. 2 S.
Lexington
AIRPORT
LEXINGTON CEMETERY
Willow Creek
Clarks Canyon
Blackhorse Canyon
Pieper Canyon
Sourdough Canyon
UNION PACIFIC
74
207
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
30B
30C
30D
28E
45B
45C
45D
46E
11
36
34F
75B
75C
44B
44C
44D
63B
63C
64D
65D
43D
4D
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON NO. 59

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MORROW COUNTY, OREGON — SHEET NUMBER 60


N
(Joins sheet 53)
(Joins sheet 59)
(Joins sheet 61)
(Joins sheet 67)
R. 26 E. | R. 27 E.
2 255 000 FEET
650 000 FEET
640 000 FEET
2 225 000 FEET
T. 2 S. | T. 1 S.
Bell
Canyon
Blackhorse
Canyon
Sand
Hollow
Sourdough
Canyon
29
28
27
26
25
30
32
33
34
35
36
31
6
5
4
3
2
1
45D
30B
30D
30C
28E
30B
4D
64D
65D
28E
43D
43F
63B
63C
43E
65E
11
78
43C
34F
65D
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON — SHEET NUMBER 61

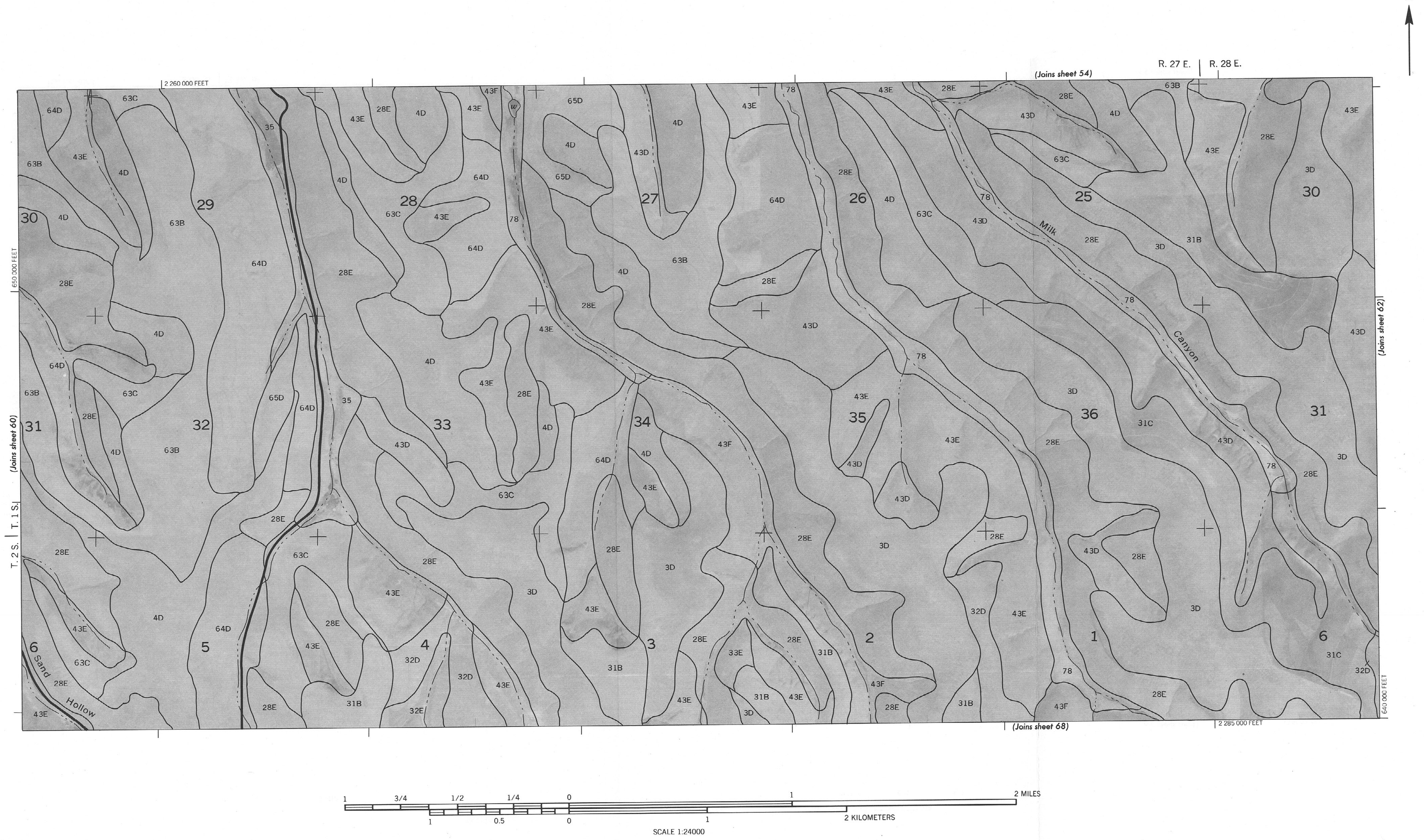
(61)

MORROW COUNTY, OREGON NO. 61

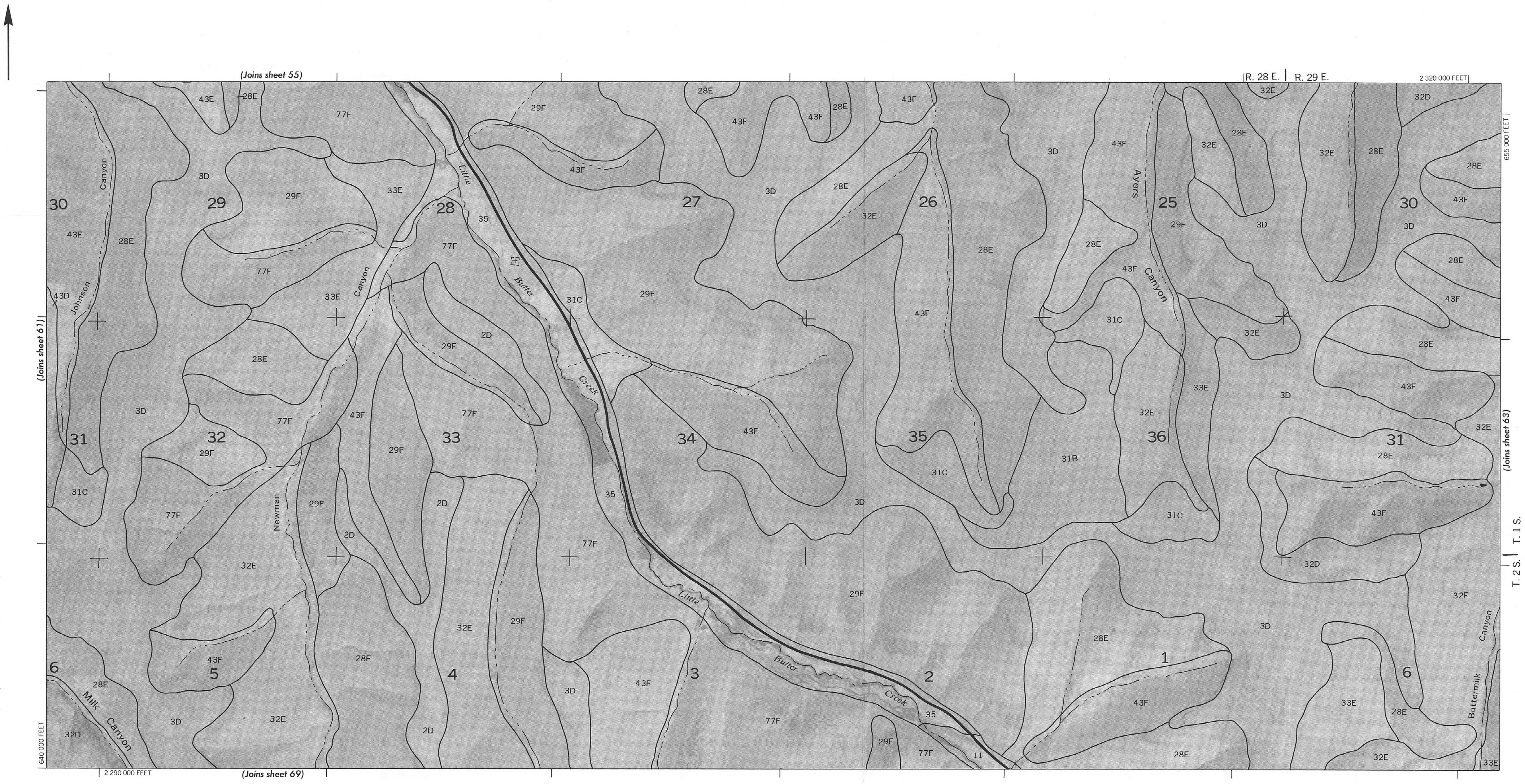
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
R. 27 E.
R. 28 E.
(Joins sheet 54)
(Joins sheet 60)
(Joins sheet 62)
(Joins sheet 68)
2 260 000 FEET
2 285 000 FEET
650 000 FEET
640 000 FEET
T. 1 S.
T. 2 S.
Milk Canyon
Sand Hollow
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
64D
63C
63B
43E
4D
28E
65D
43F
43D
35
78
3D
31B
31C
32D
32E
33E
3D
64D
65D
w
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 62


N
(Joins sheet 55)
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 69)
R. 28 E.
R. 29 E.
T. 1 S.
T. 2 S.
2 320 000 FEET
655 000 FEET
640 000 FEET
2 290 000 FEET
Johnson Canyon
Canyon
Newman
Little Butter Creek
Ayers Canyon
Milk Canyon
Buttermilk Canyon
30
29
28
27
26
25
30
31
32
33
34
35
36
31
6
5
4
3
2
1
6
43E
28E
77F
29F
3D
33E
35
77F
43F
28E
32E
3D
31C
2D
29F
43D
31B
32D
43F
31C
77F
2D
11
33E
28E

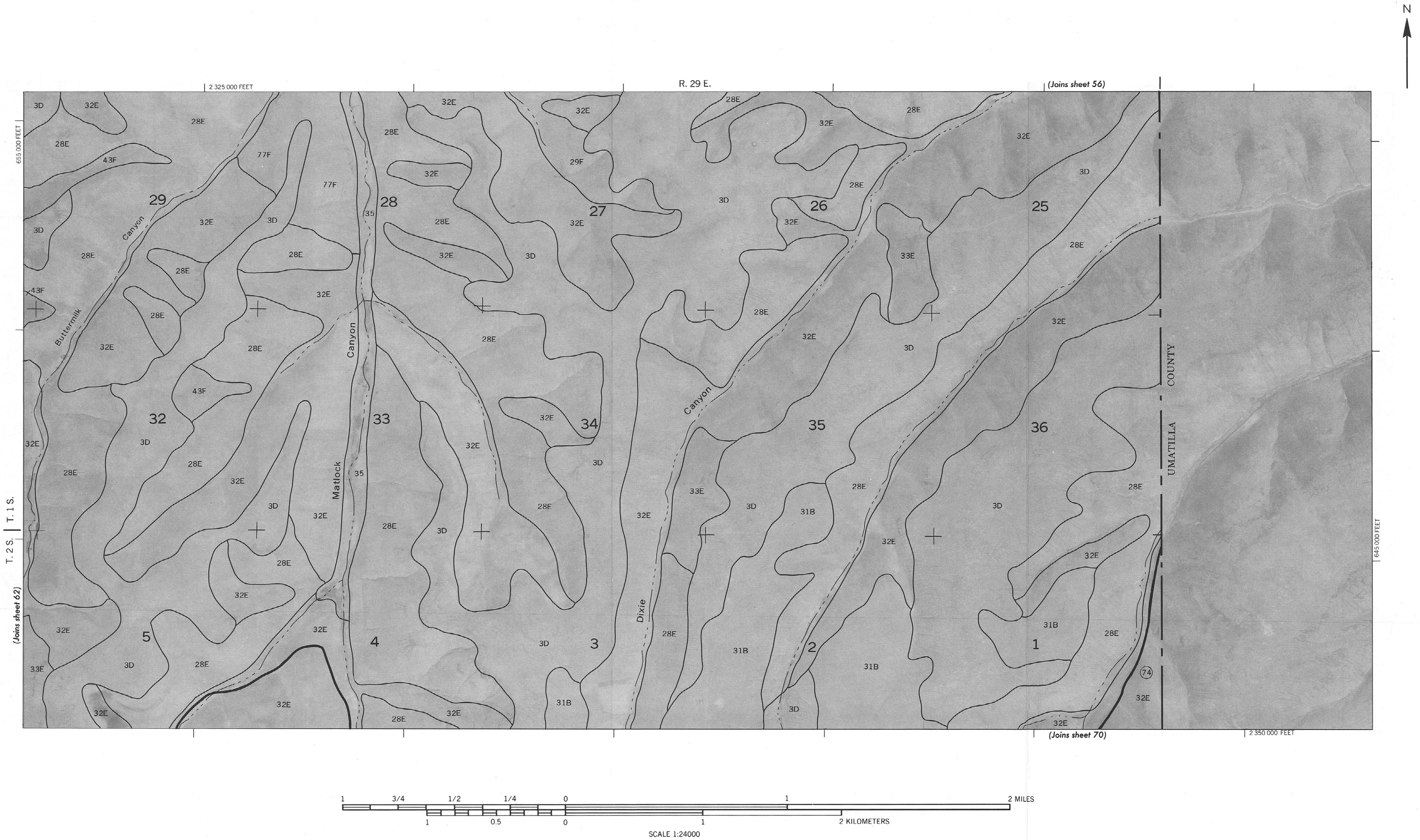
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

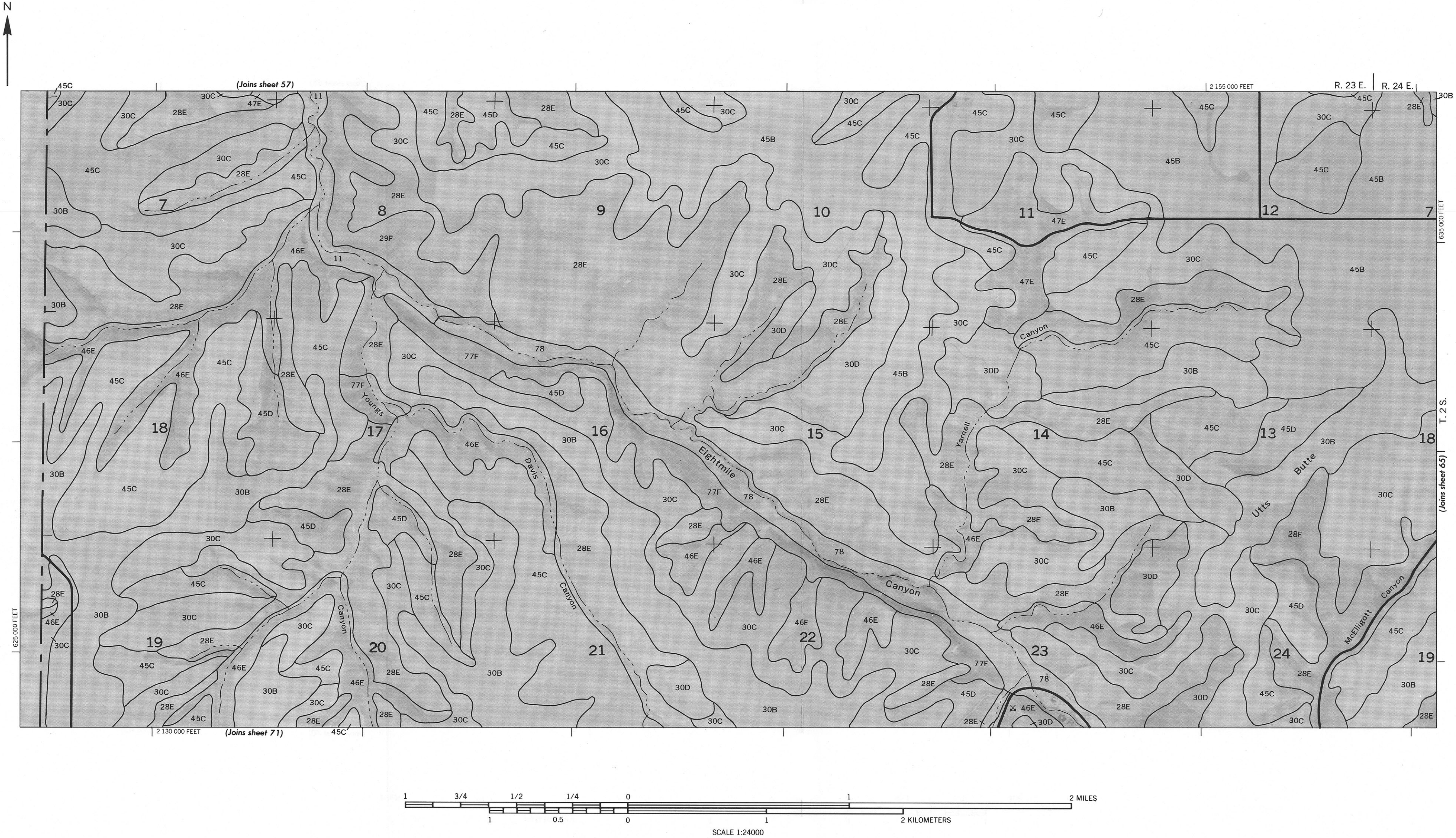
MORROW COUNTY, OREGON — SHEET NUMBER 63


N
R. 29 E.
2 325 000 FEET
655 000 FEET
645 000 FEET
2 350 000 FEET
(Joins sheet 56)
(Joins sheet 62)
(Joins sheet 70)
T. 1 S.
T. 2 S.
UMATILLA COUNTY
Buttermilk Canyon
Matlock Canyon
Dixie Canyon
74
29
28
27
26
25
32
33
34
35
36
5
4
3
2
1
3D
32E
28E
43F
77F
35
29F
33E
43F
31B
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON NO. 63

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MORROW COUNTY, OREGON — SHEET NUMBER 64


N
(Joins sheet 57)
(Joins sheet 65)
(Joins sheet 71)
2 155 000 FEET
2 130 000 FEET
635 000 FEET
625 000 FEET
R. 23 E.
R. 24 E.
T. 2 S.
7
8
9
10
11
12
7
18
17
16
15
14
13
18
19
20
21
22
23
24
19
Youngs
Davis
Canyon
Eightmile
Canyon
Canyon
Yarnell
Canyon
Utts
Butte
McElligott
Canyon
45C
30C
28E
47E
11
45D
45B
30B
46E
29F
77F
78
30D
46E
28E
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

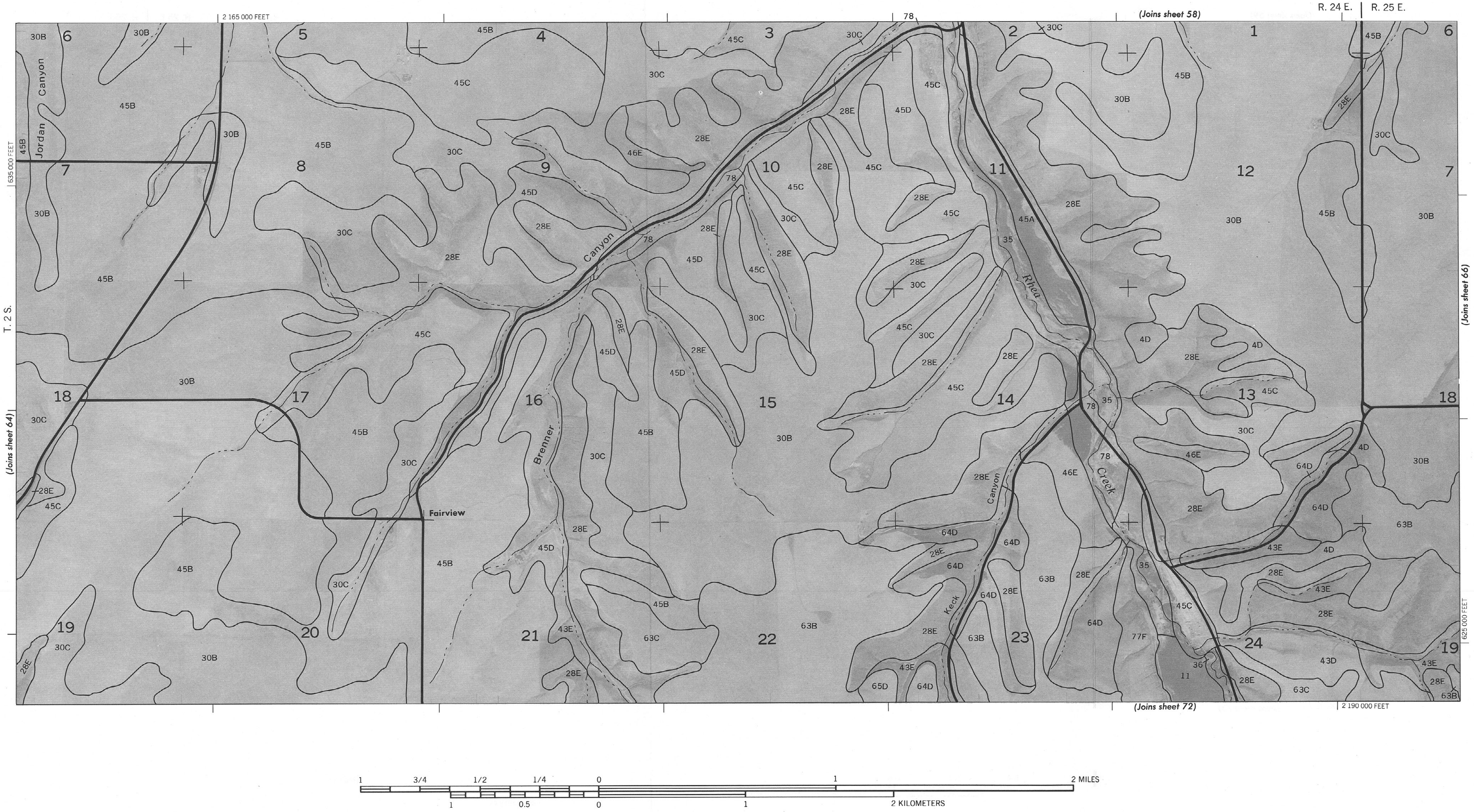
MORROW COUNTY, OREGON NO. 64

MORROW COUNTY, OREGON — SHEET NUMBER 65

65

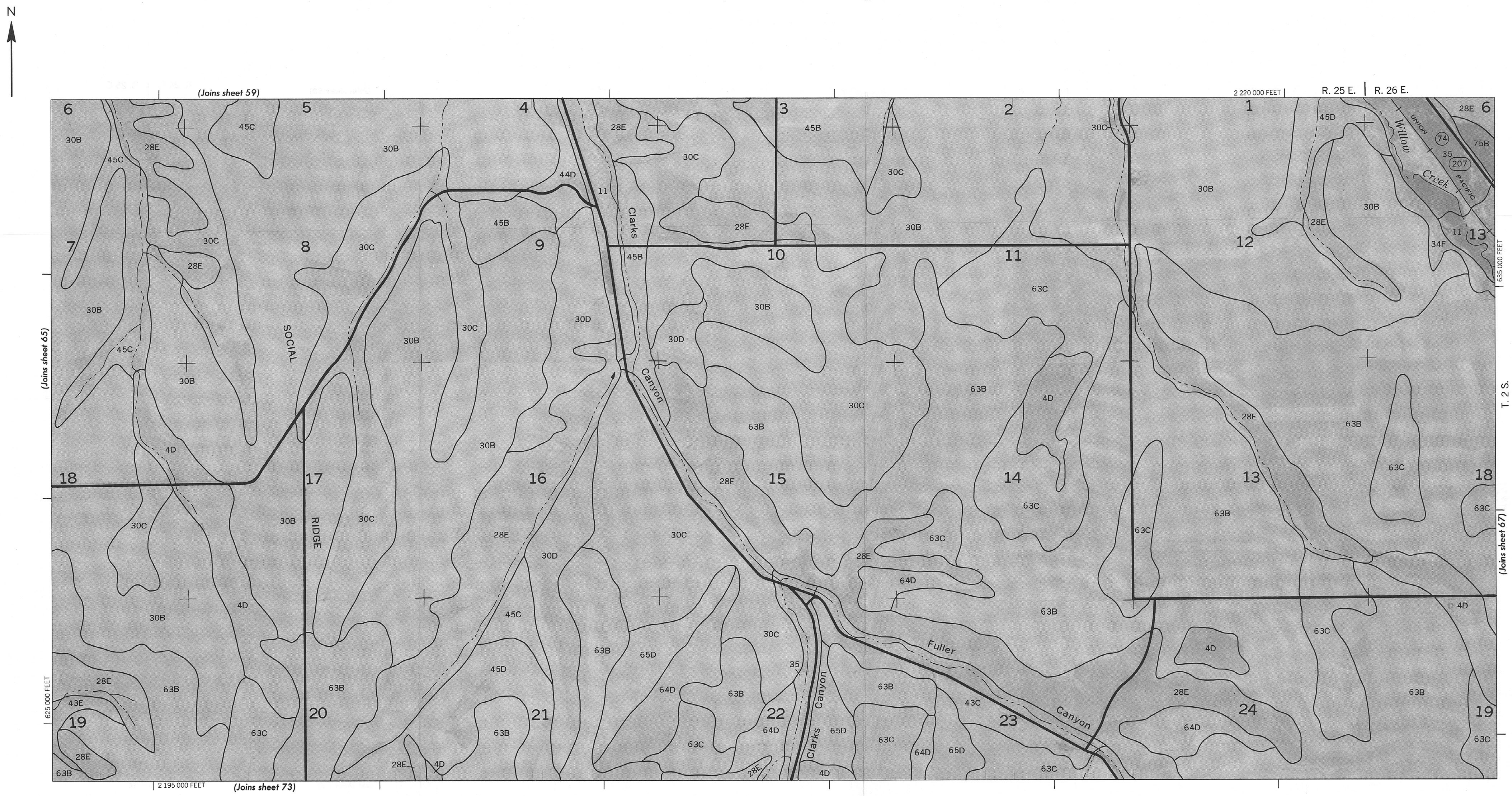
MORROW COUNTY, OREGON NO. 65

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
2 165 000 FEET
78
(Joins sheet 58)
R. 24 E.
R. 25 E.
635 000 FEET
T. 2 S.
(Joins sheet 64)
(Joins sheet 66)
625 000 FEET
(Joins sheet 72)
2 190 000 FEET
Jordan Canyon
Canyon
Brenner
Rhea
Creek
Keck
Fairview
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
30B
30C
45B
45C
45D
45A
46E
46E
28E
35
36
11
4D
43E
43D
63B
63C
64D
65D
77F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 66


N
(Joins sheet 59)
(Joins sheet 65)
(Joins sheet 67)
(Joins sheet 73)
2 220 000 FEET
2 195 000 FEET
635 000 FEET
625 000 FEET
R. 25 E.
R. 26 E.
T. 2 S.
SOCIAL
RIDGE
Clarks
Canyon
Fuller
Canyon
Willow
Creek
UNION
PACIFIC
74
207
35
11
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
30B
30C
30D
28E
45B
45C
45D
44D
4D
63B
63C
64D
65D
43C
43E
34F
75B

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 66

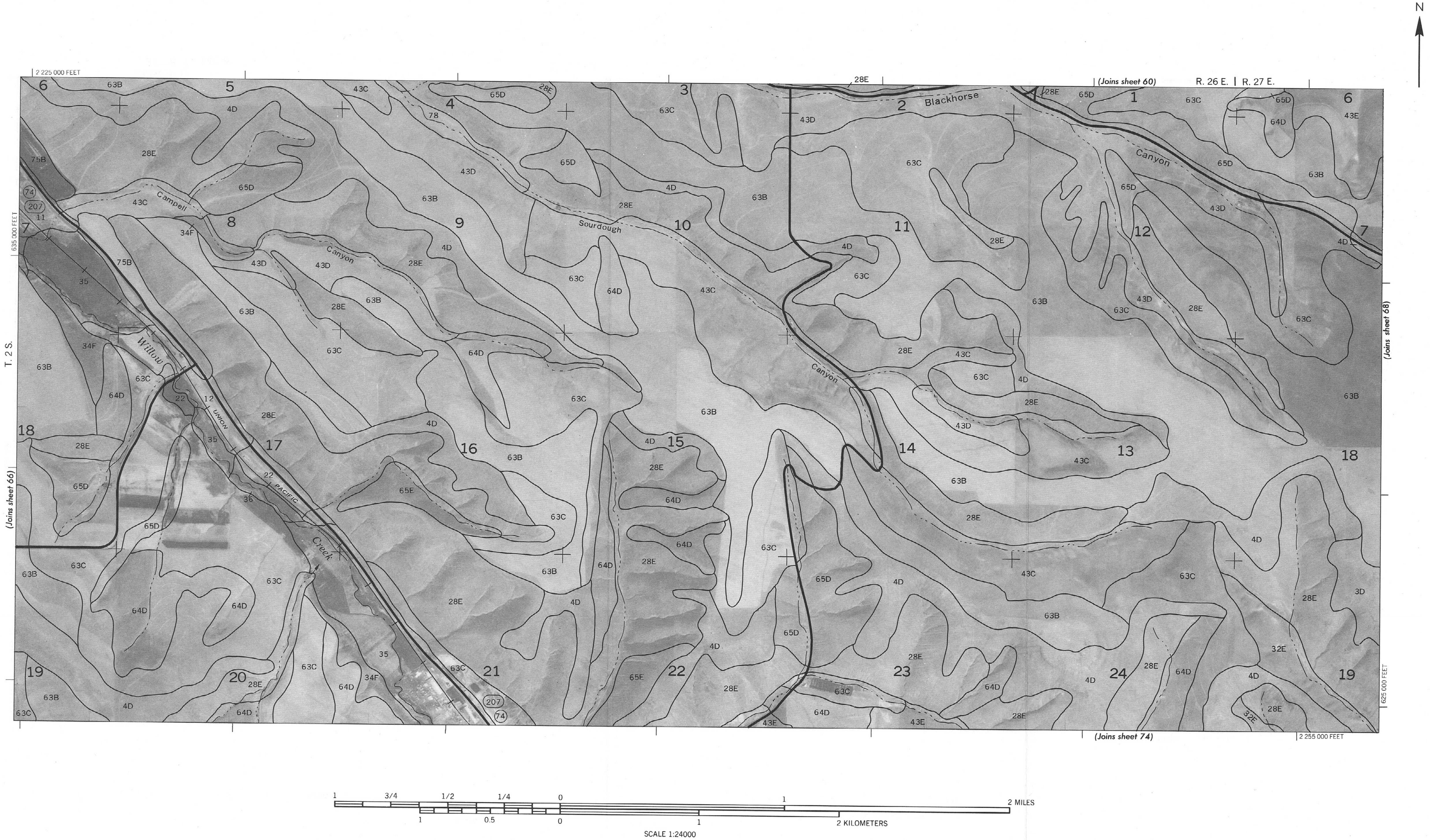
MORROW COUNTY, OREGON — SHEET NUMBER 67

MORROW COUNTY, OREGON NO. 67

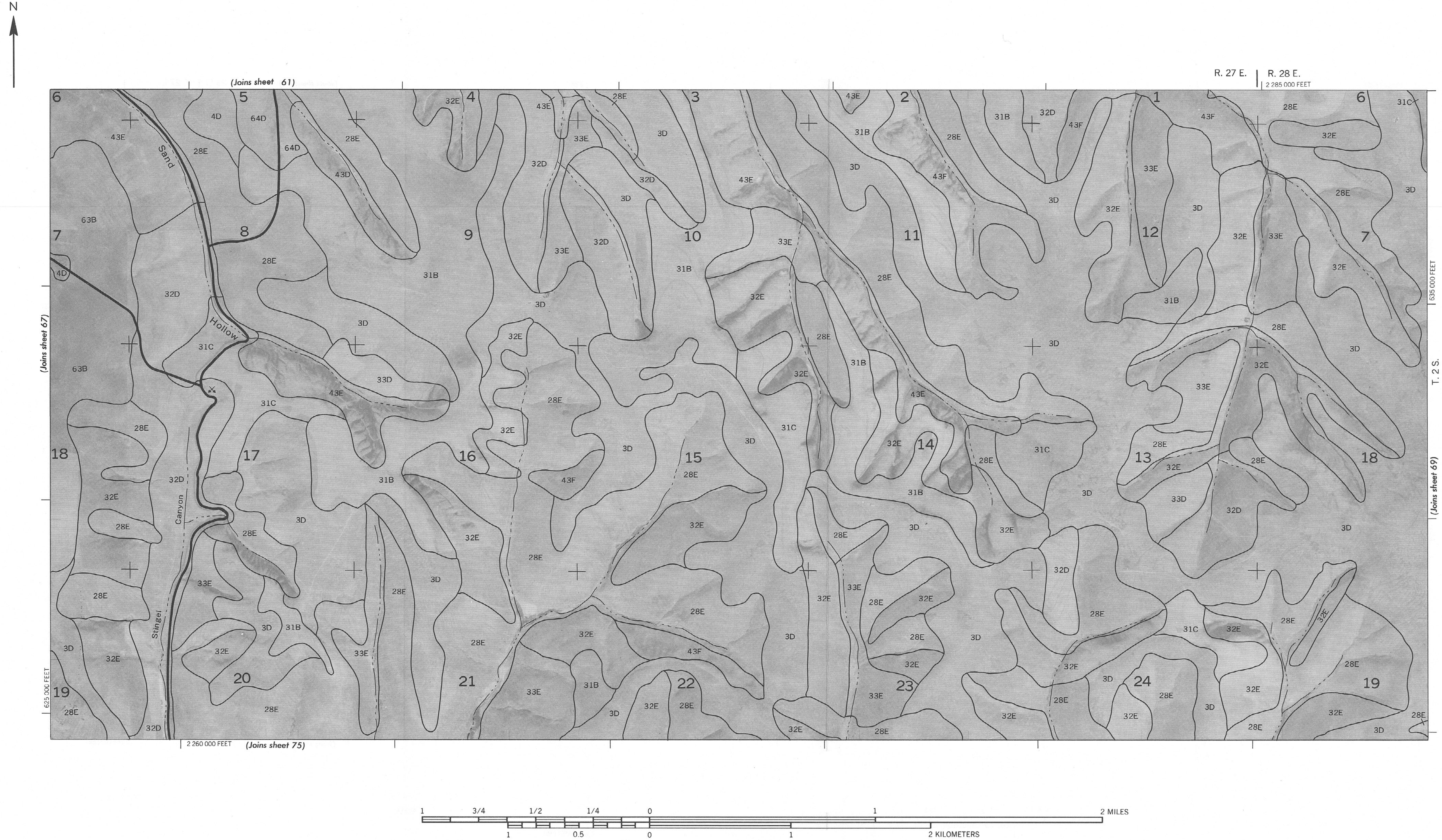
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
2 225 000 FEET
(Joins sheet 60)
R. 26 E. | R. 27 E.
(Joins sheet 66)
(Joins sheet 68)
(Joins sheet 74)
T. 2 S.
635 000 FEET
625 000 FEET
2 255 000 FEET
Blackhorse Canyon
Sourdough Canyon
Campell Canyon
Willow Creek
UNION PACIFIC
74
207
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
3D
4D
22
28E
32E
34F
35
36
43C
43D
43E
63B
63C
64D
65D
65E
75B
78
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 68


N
(Joins sheet 61)
R. 27 E.
R. 28 E.
2 285 000 FEET
(Joins sheet 67)
(Joins sheet 69)
(Joins sheet 75)
2 260 000 FEET
625 000 FEET
635 000 FEET
T. 2 S.
Sand
Hollow
Stingel
Canyon
6
5
4
3
2
1
6
7
8
9
10
11
12
7
18
17
16
15
14
13
18
19
20
21
22
23
24
19
43E
4D
64D
28E
64D
43D
28E
63B
32D
31C
63B
31C
43E
33D
3D
31B
28E
32E
32D
32E
28E
28E
33E
3D
31B
32E
20
28E
32D
3D
32E
19
28E
3D
28E
33E
32E
31B
3D
43E
33E
32D
3D
32D
33E
32D
3D
31B
32E
28E
32E
43F
3D
28E
32E
28E
33E
31B
3D
32E
28E
28E
43F
32E
28E
43E
31B
3D
43E
33E
32E
28E
31B
32E
31C
3D
28E
32E
33E
28E
32E
28E
3D
32E
33E
28E
31B
28E
43F
3D
43E
31C
28E
32E
31B
3D
32E
32D
28E
3D
28E
32E
31C
32E
3D
28E
32E
32D
43F
33E
3D
32E
12
33E
31B
3D
28E
32E
33E
3D
43F
28E
32E
31C
32E
28E
32E
32E
3D
28E
32E
33E
28E
32E
33D
32D
3D
28E
32E
28E
3D
31C
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

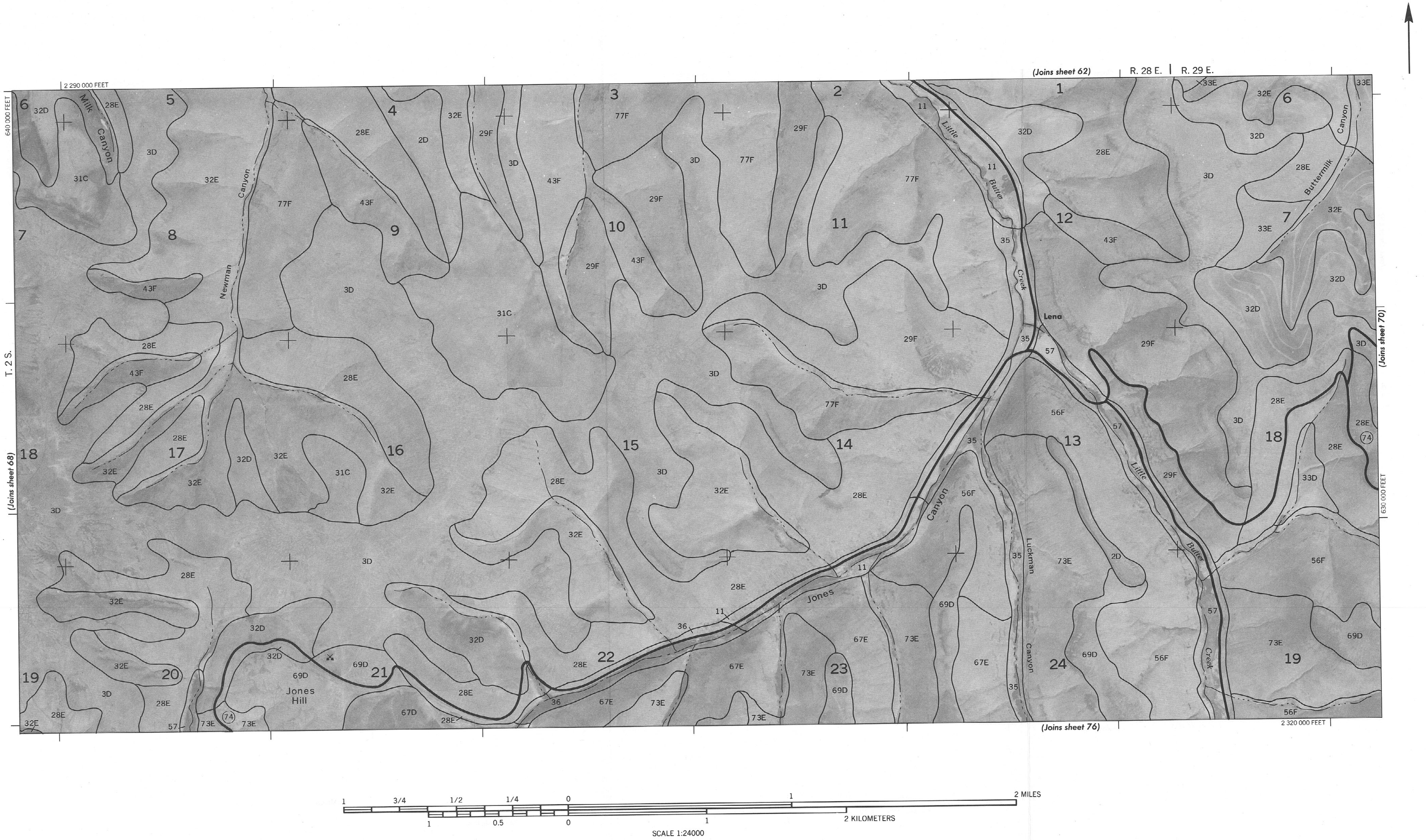
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 68

MORROW COUNTY, OREGON — SHEET NUMBER 69

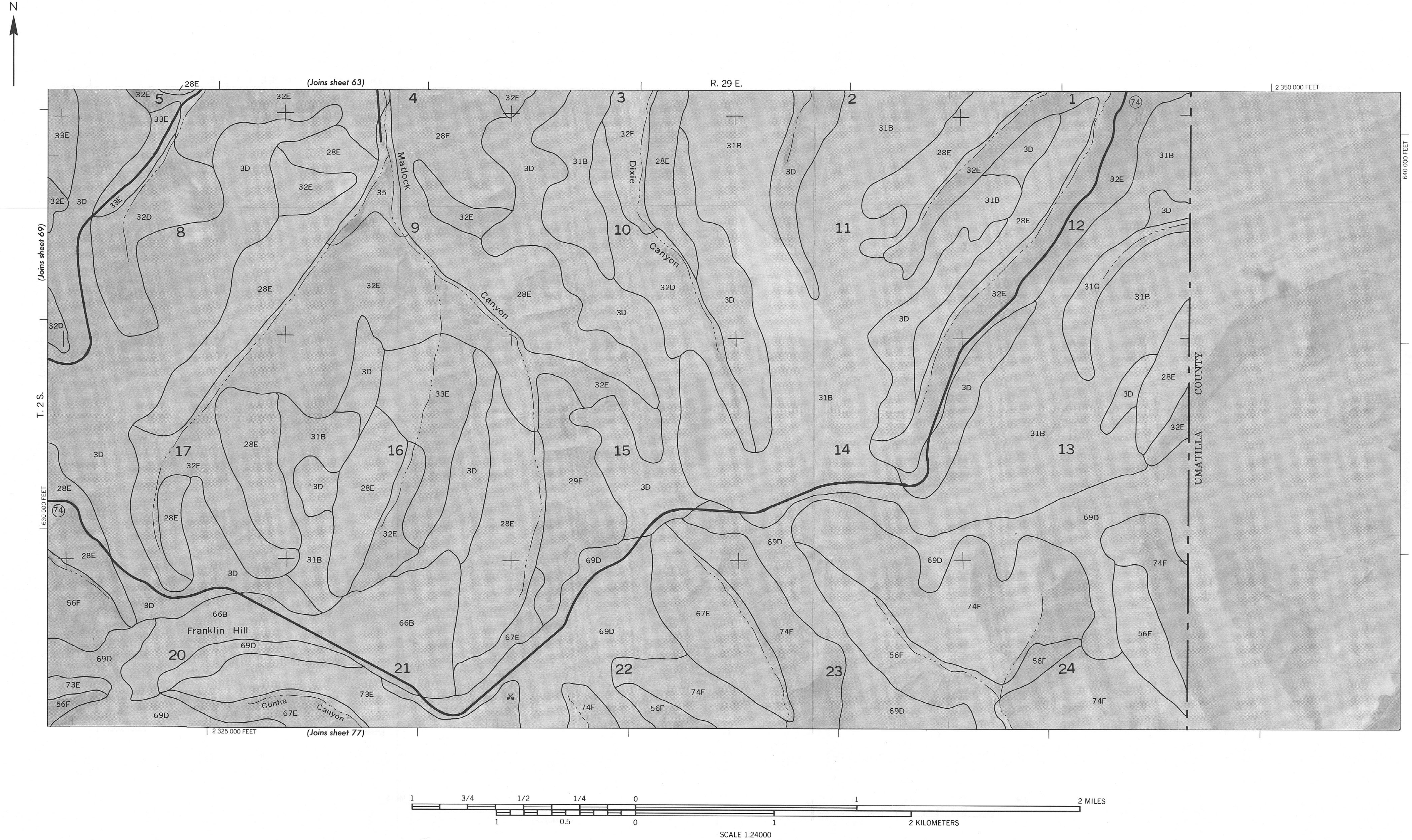
MORROW COUNTY, OREGON NO. 69

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
(Joins sheet 62)
R. 28 E.
R. 29 E.
(Joins sheet 68)
(Joins sheet 70)
(Joins sheet 76)
T. 2 S.
2 290 000 FEET
640 000 FEET
630 000 FEET
2 320 000 FEET
Milk Canyon
Newman Canyon
Little Butter Creek
Buttermilk Canyon
Lena
Jones Canyon
Luckman Canyon
Jones Hill
74
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
2D
3D
11
31C
32D
32E
33D
33E
28E
29F
35
36
43F
56F
57
67D
67E
69D
73E
77F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

⑦⓪

MORROW COUNTY, OREGON — SHEET NUMBER 70


N
(Joins sheet 63)
R. 29 E.
2 350 000 FEET
640 000 FEET
(Joins sheet 69)
T. 2 S.
630 000 FEET
2 325 000 FEET
(Joins sheet 77)
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
20
21
22
23
24
74
Matlock
Canyon
Dixie
Canyon
Franklin Hill
Cunha
Canyon
UMATILLA
COUNTY
28E
32E
33E
3D
32D
35
31B
31C
29F
66B
67E
69D
73E
74F
56F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

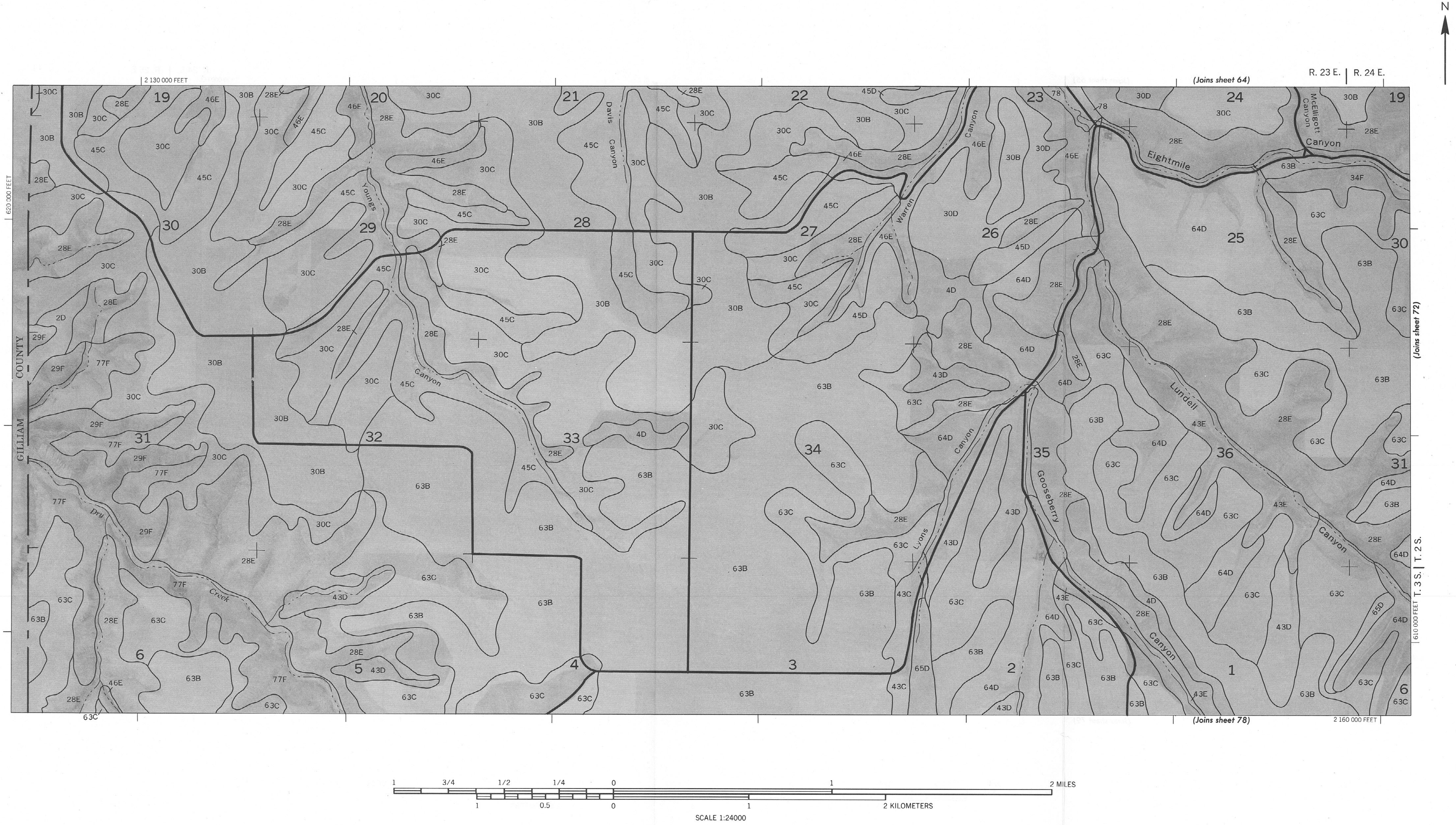
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 70

MORROW COUNTY, OREGON — SHEET NUMBER 71

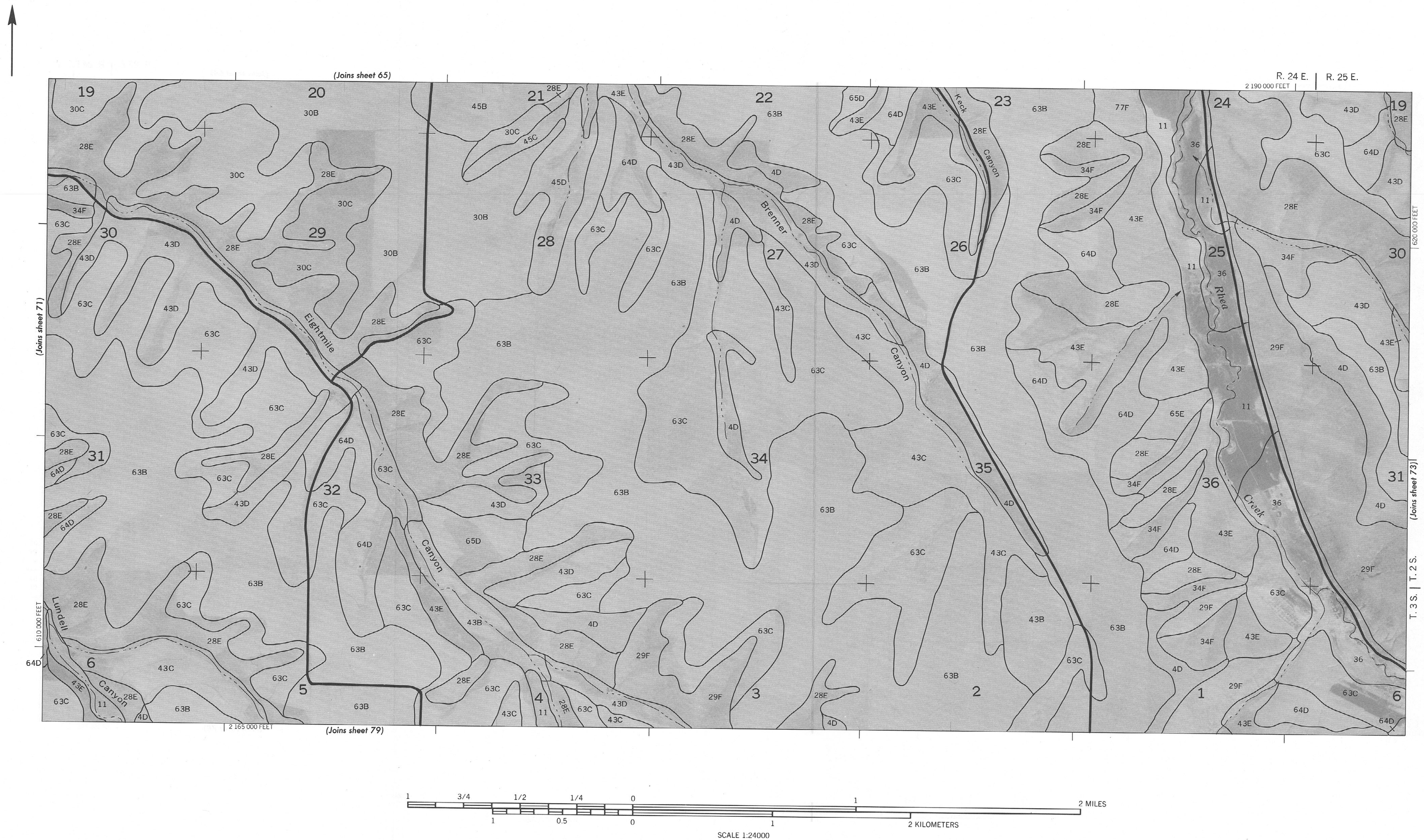

N
R. 23 E. | R. 24 E.
(Joins sheet 64)
(Joins sheet 72)
(Joins sheet 78)
T. 2 S. | T. 3 S.
2 130 000 FEET
2 160 000 FEET
620 000 FEET
610 000 FEET
GILLIAM COUNTY
Eightmile
McElligott Canyon
Canyon
Davis Canyon
Youngs Canyon
Warren Canyon
Lundell Canyon
Gooseberry Canyon
Lyons Canyon
Dry Creek
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
1
2
3
4
5
6
30B
30C
30D
28E
45C
45D
46E
4D
2D
29F
77F
63B
63C
64D
65D
43C
43D
43E
34F
78
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON NO. 71

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(72)

MORROW COUNTY, OREGON — SHEET NUMBER 72

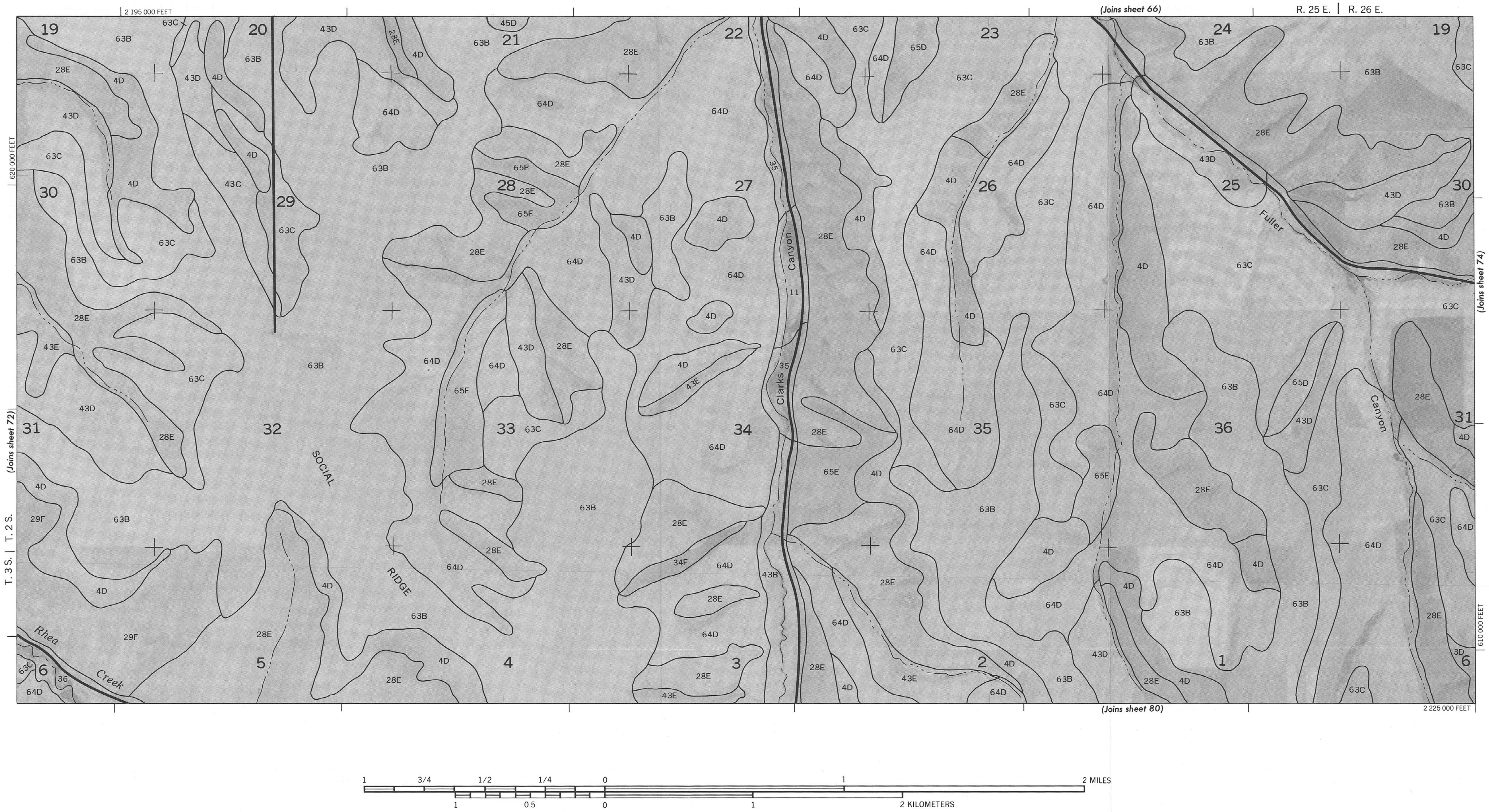

N
(Joins sheet 65)
(Joins sheet 71)
(Joins sheet 73)
(Joins sheet 79)
R. 24 E.
R. 25 E.
T. 3 S.
T. 2 S.
2 190 000 FEET
2 165 000 FEET
620 000 FEET
610 000 FEET
19
20
21
22
23
24
19
30C
30B
28E
45B
45C
45D
43E
63B
65D
64D
77F
11
36
43D
30
29
28
27
26
25
30
63C
34F
4D
43C
65E
29F
Eightmile
Brenner
Canyon
Keck
Canyon
Rhea
Creek
31
32
33
34
35
36
31
Lundell
Canyon
6
5
4
3
2
1
6
SCALE 1:24000
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 72

MORROW COUNTY, OREGON — SHEET NUMBER 73

N


2 195 000 FEET
(Joins sheet 66)
R. 25 E. | R. 26 E.
620 000 FEET
(Joins sheet 72)
T. 2 S.
T. 3 S.
(Joins sheet 74)
610 000 FEET
(Joins sheet 80)
2 225 000 FEET
19
20
21
22
23
24
19
30
29
28
27
26
25
30
31
32
33
34
35
36
31
6
5
4
3
2
1
6
SOCIAL
RIDGE
Clarks
Canyon
Fuller
Canyon
Rhea
Creek
35
11
63B
63C
28E
4D
43D
43C
43E
64D
65E
65D
45D
29F
34F
43B
3D
36
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

MORROW COUNTY, OREGON NO. 73

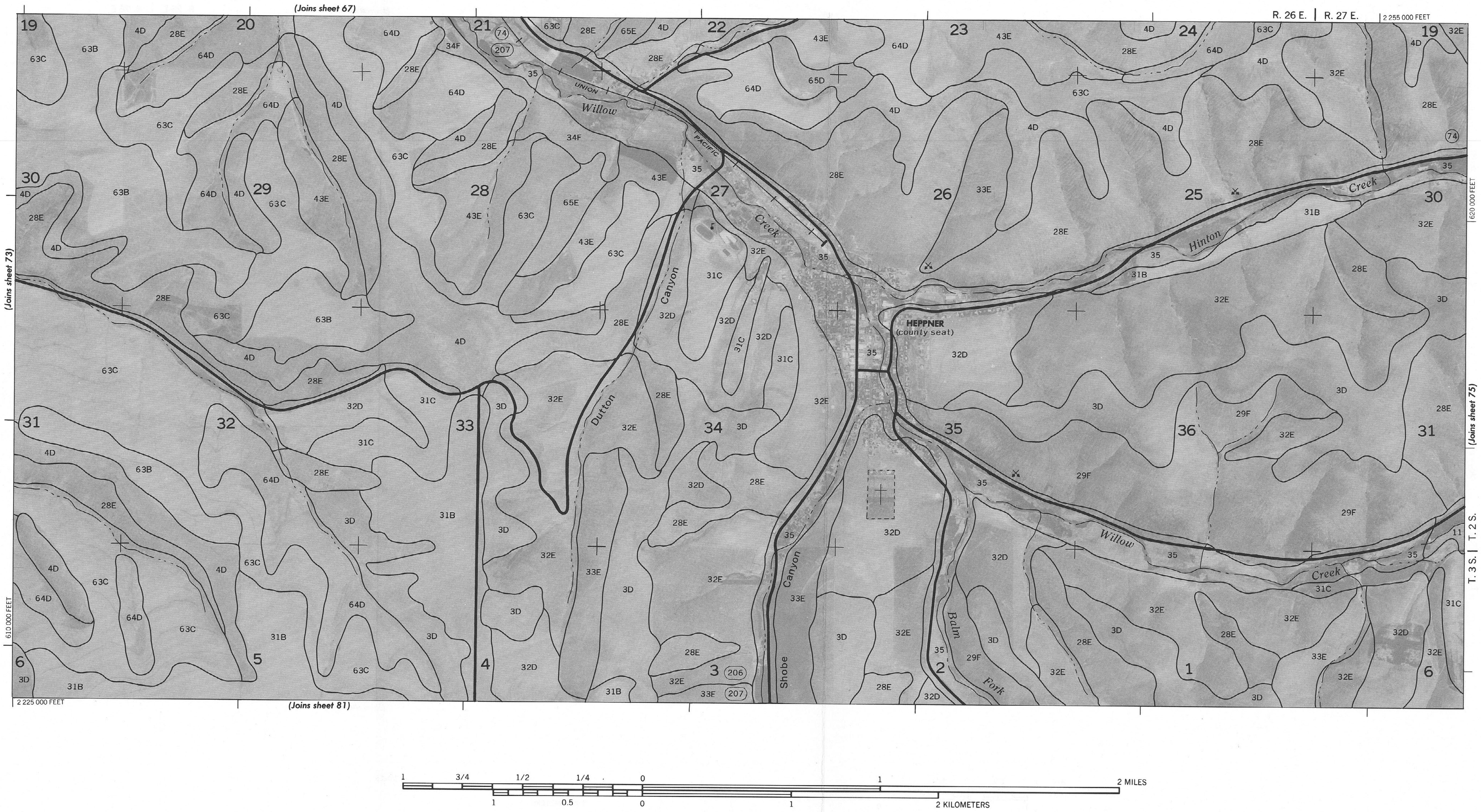
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

74

MORROW COUNTY, OREGON — SHEET NUMBER 74

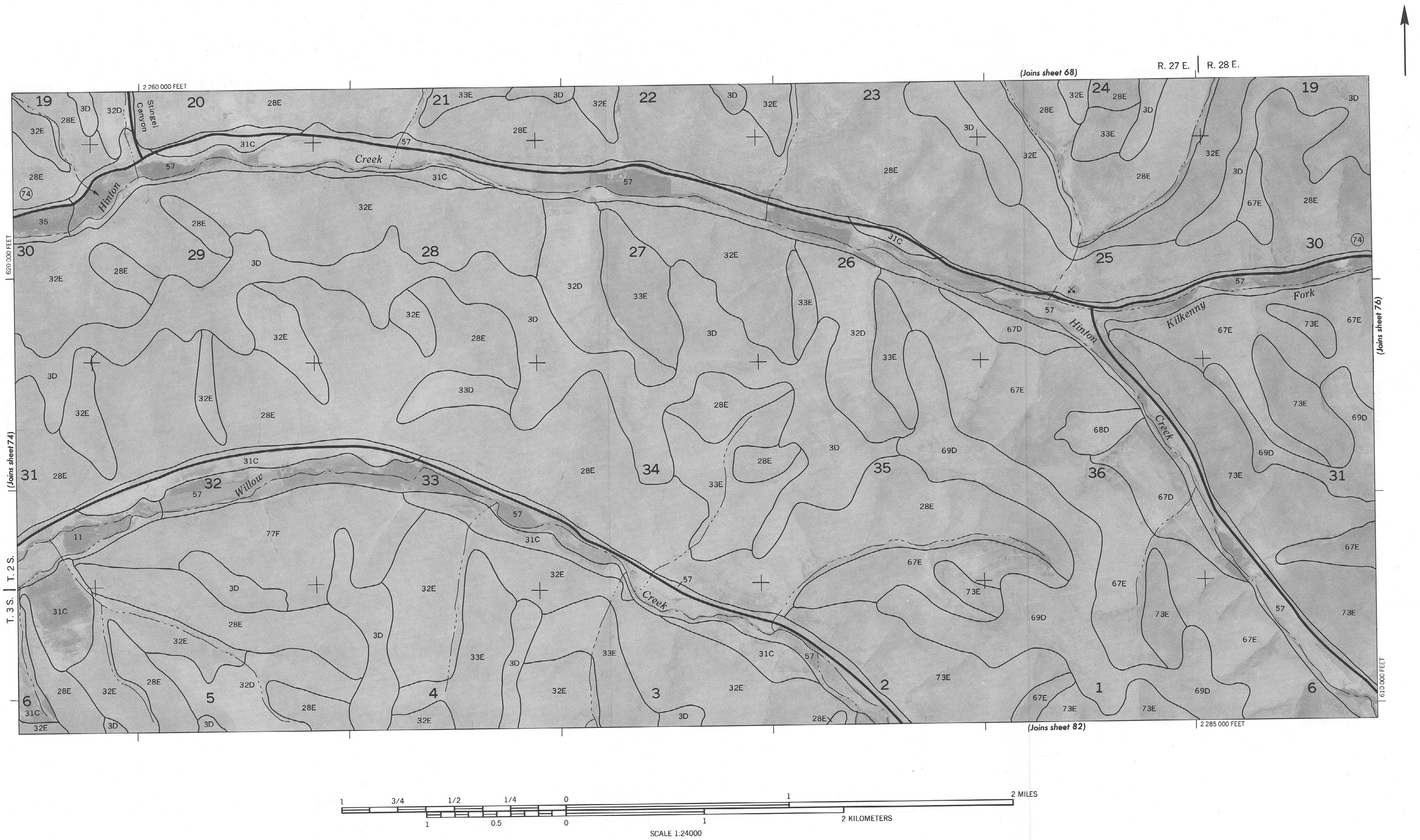

(Joins sheet 67)
(Joins sheet 73)
(Joins sheet 75)
(Joins sheet 81)
R. 26 E.
R. 27 E.
T. 2 S.
T. 3 S.
2 255 000 FEET
2 225 000 FEET
620 000 FEET
610 000 FEET
HEPPNER
(county seat)
Willow
Creek
Hinton
Creek
Willow
Creek
Canyon
Dutton
Shobe
Canyon
Balm
Fork
UNION
PACIFIC
74
207
206
207
19
20
21
22
23
24
19
30
29
28
27
26
25
30
31
32
33
34
35
36
31
6
5
4
3
2
1
6
11
63C
63B
4D
28E
64D
34F
35
43E
65E
63C
65D
32E
31C
32D
3D
31B
33E
29F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 74

MORROW COUNTY, OREGON — SHEET NUMBER 75


N
(Joins sheet 68)
R. 27 E.
R. 28 E.
2 260 000 FEET
620 000 FEET
(Joins sheet 74)
(Joins sheet 76)
(Joins sheet 82)
2 285 000 FEET
610 000 FEET
T. 2 S.
T. 3 S.
19
20
21
22
23
24
19
30
29
28
27
26
25
30
31
32
33
34
35
36
31
6
5
4
3
2
1
6
Stingel Canyon
Hinton
Creek
Hinton
Creek
Kilkenny
Fork
Willow
Creek
74
74
3D
32D
32E
28E
33E
31C
57
35
32D
33D
67D
67E
68D
69D
73E
77F
11
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

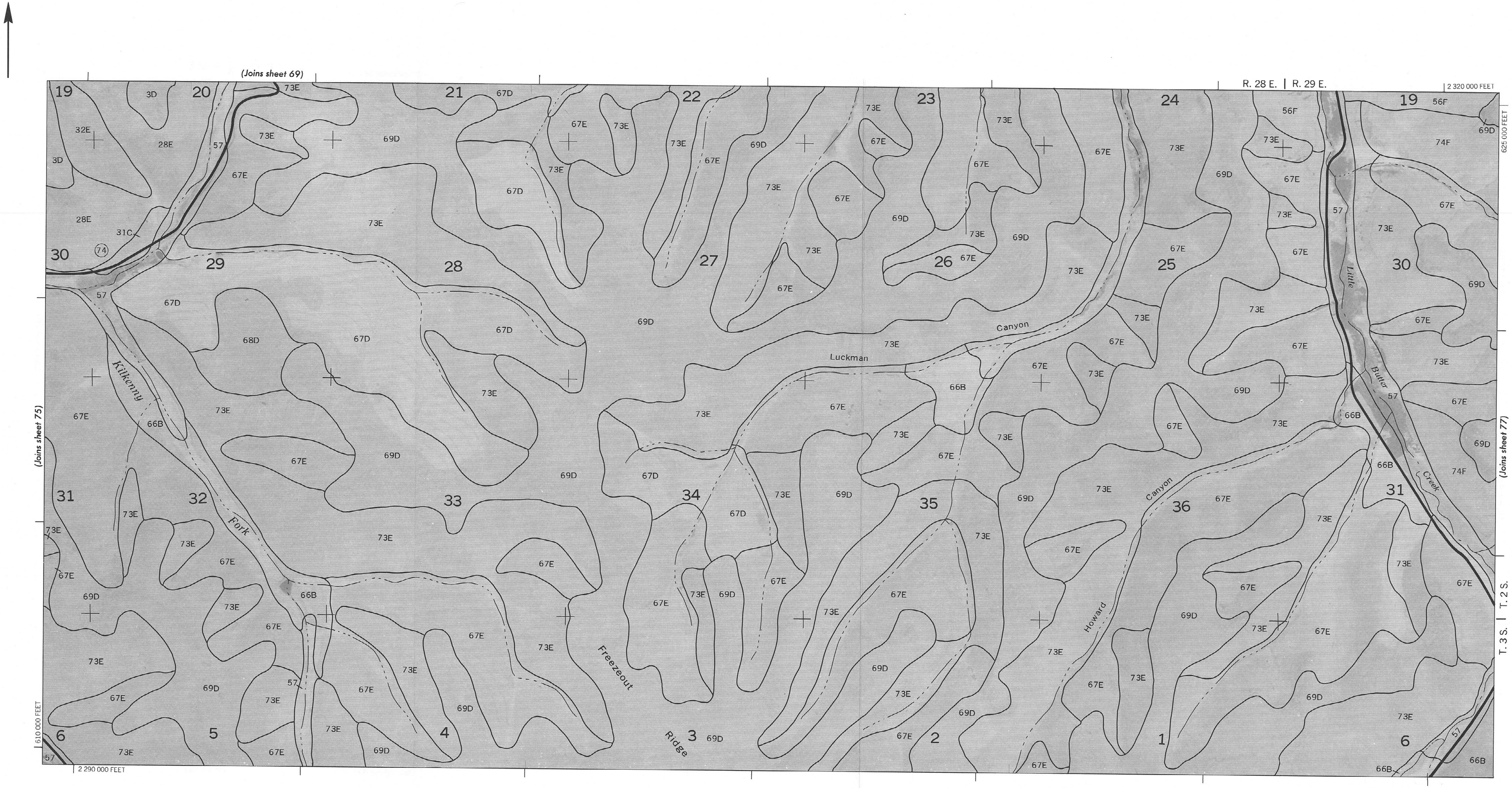
MORROW COUNTY, OREGON NO. 75

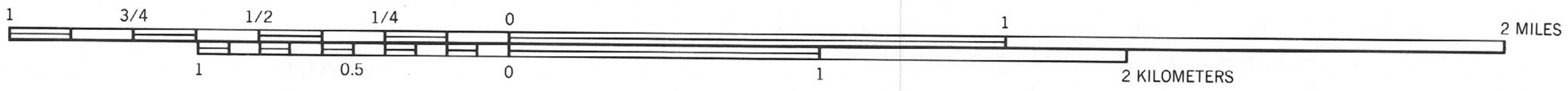
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MORROW COUNTY, OREGON — SHEET NUMBER 76


N
(Joins sheet 69)
(Joins sheet 75)
(Joins sheet 77)
R. 28 E. | R. 29 E.
T. 2 S. | T. 3 S.
2 320 000 FEET
625 000 FEET
610 000 FEET
2 290 000 FEET
19
20
21
22
23
24
19
30
29
28
27
26
25
30
31
32
33
34
35
36
31
6
5
4
3
2
1
6
74
Luckman
Canyon
Kilkenny
Fork
Freezeout
Ridge
Howard
Canyon
Little
Butter
Creek


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

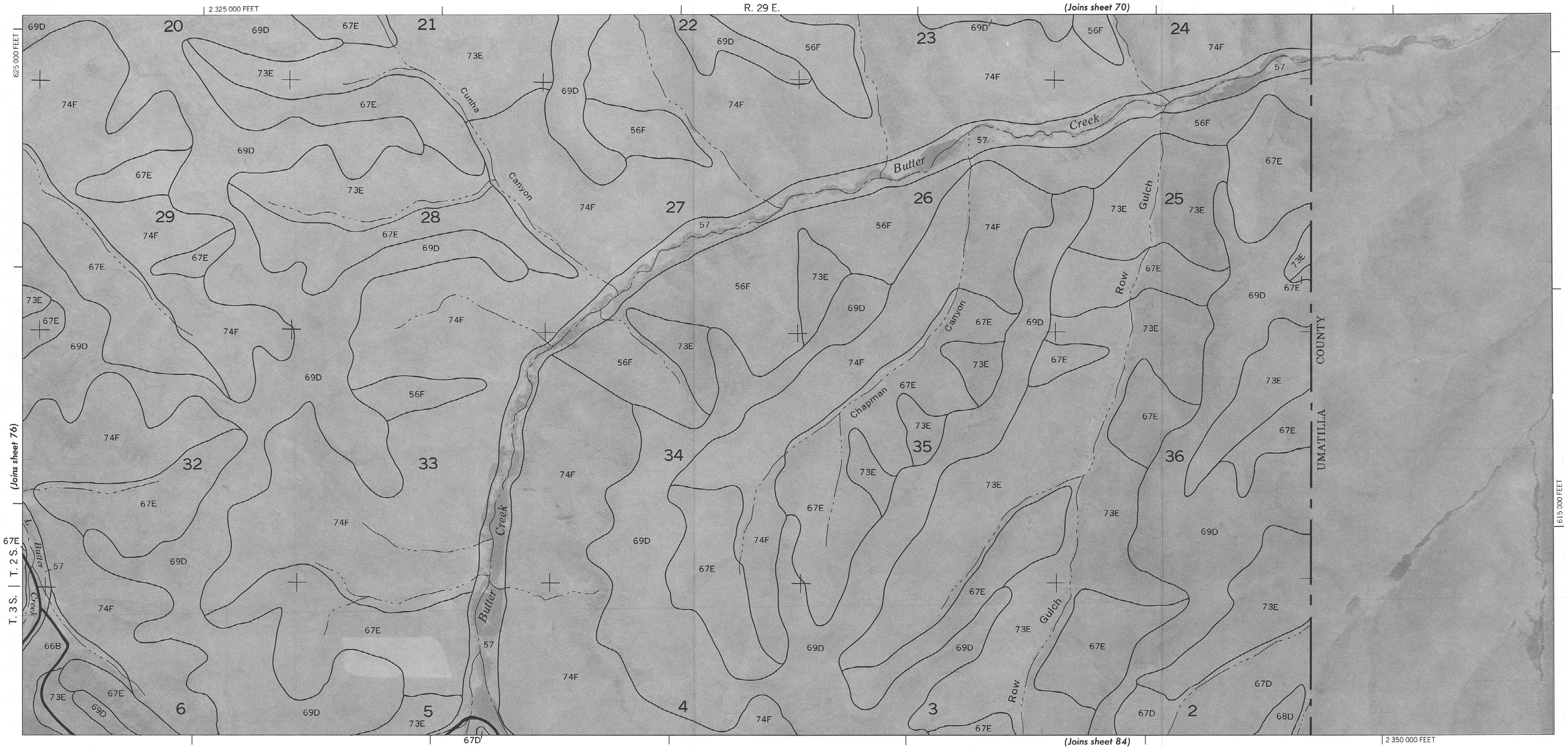
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 76

MORROW COUNTY, OREGON — SHEET NUMBER 77

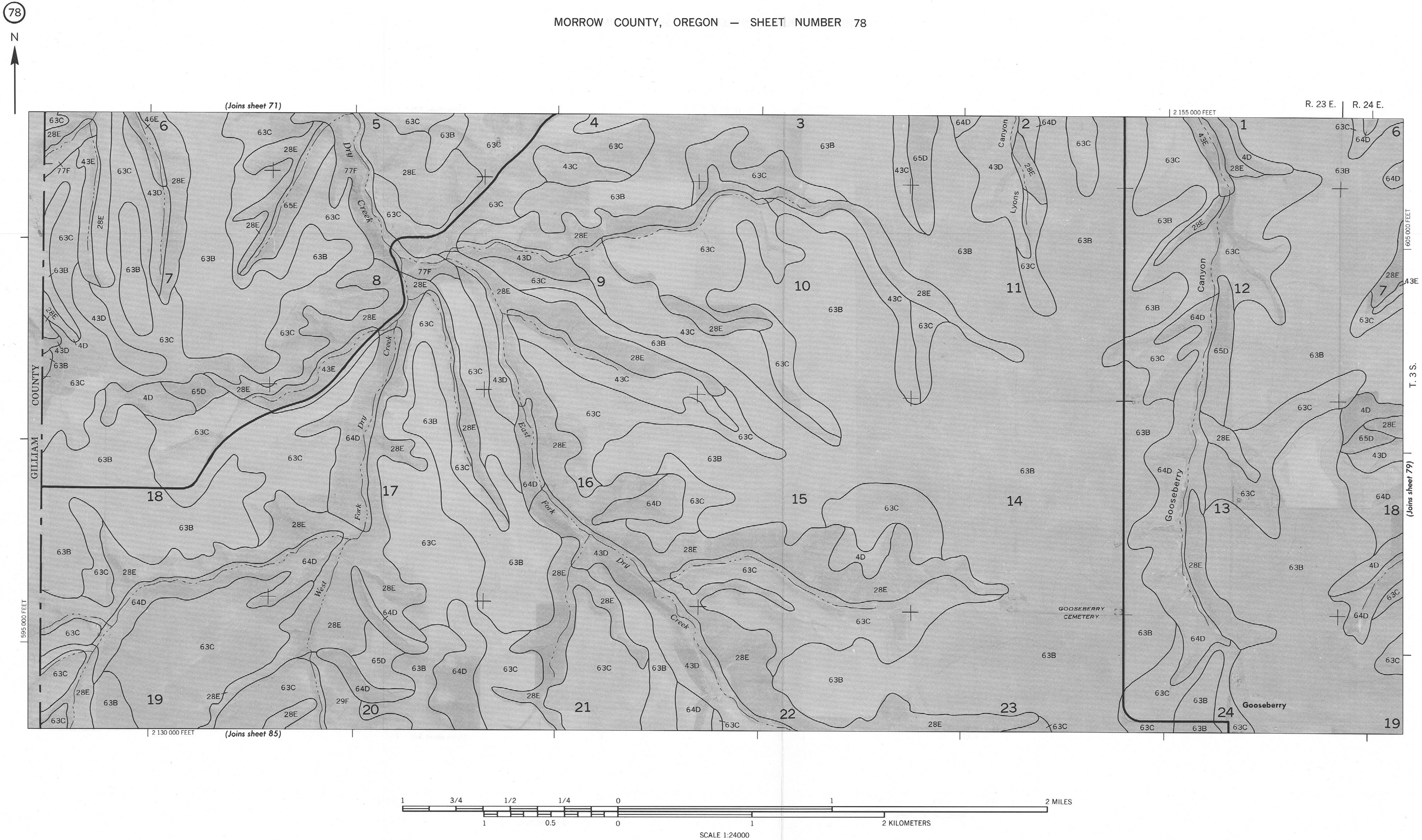
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


2 325 000 FEET
R. 29 E.
(Joins sheet 70)
625 000 FEET
(Joins sheet 76)
T. 3 S. | T. 2 S.
(Joins sheet 84)
2 350 000 FEET
615 000 FEET
UMATILLA COUNTY
20
21
22
23
24
29
28
27
26
25
32
33
34
35
36
6
5
4
3
2
Butter Creek
Cunha Canyon
Chapman Canyon
Row Gulch
69D
67E
73E
74F
56F
57
66B
67D
68D

1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 78


78
N
(Joins sheet 71)
(Joins sheet 85)
(Joins sheet 79)
R. 23 E.
R. 24 E.
T. 3 S.
2 155 000 FEET
2 130 000 FEET
605 000 FEET
595 000 FEET
GILLIAM COUNTY
Dry Creek
Dry Fork
West Fork
East Fork Dry Creek
Lyons Canyon
Canyon
Gooseberry
GOOSEBERRY CEMETERY
Gooseberry
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
63C
63B
28E
43E
43D
43C
4D
46E
64D
65D
65E
77F
29F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

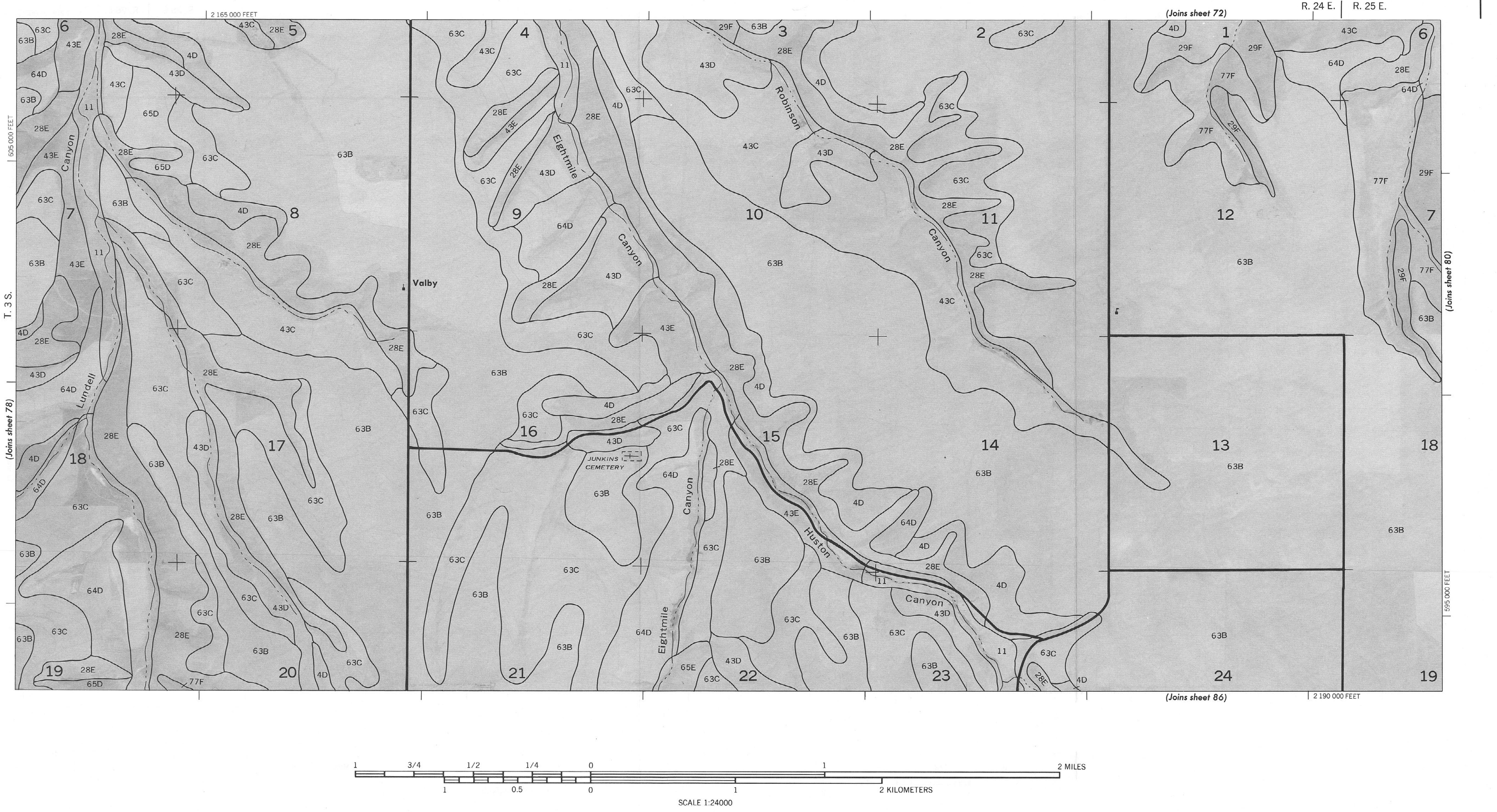
Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 78

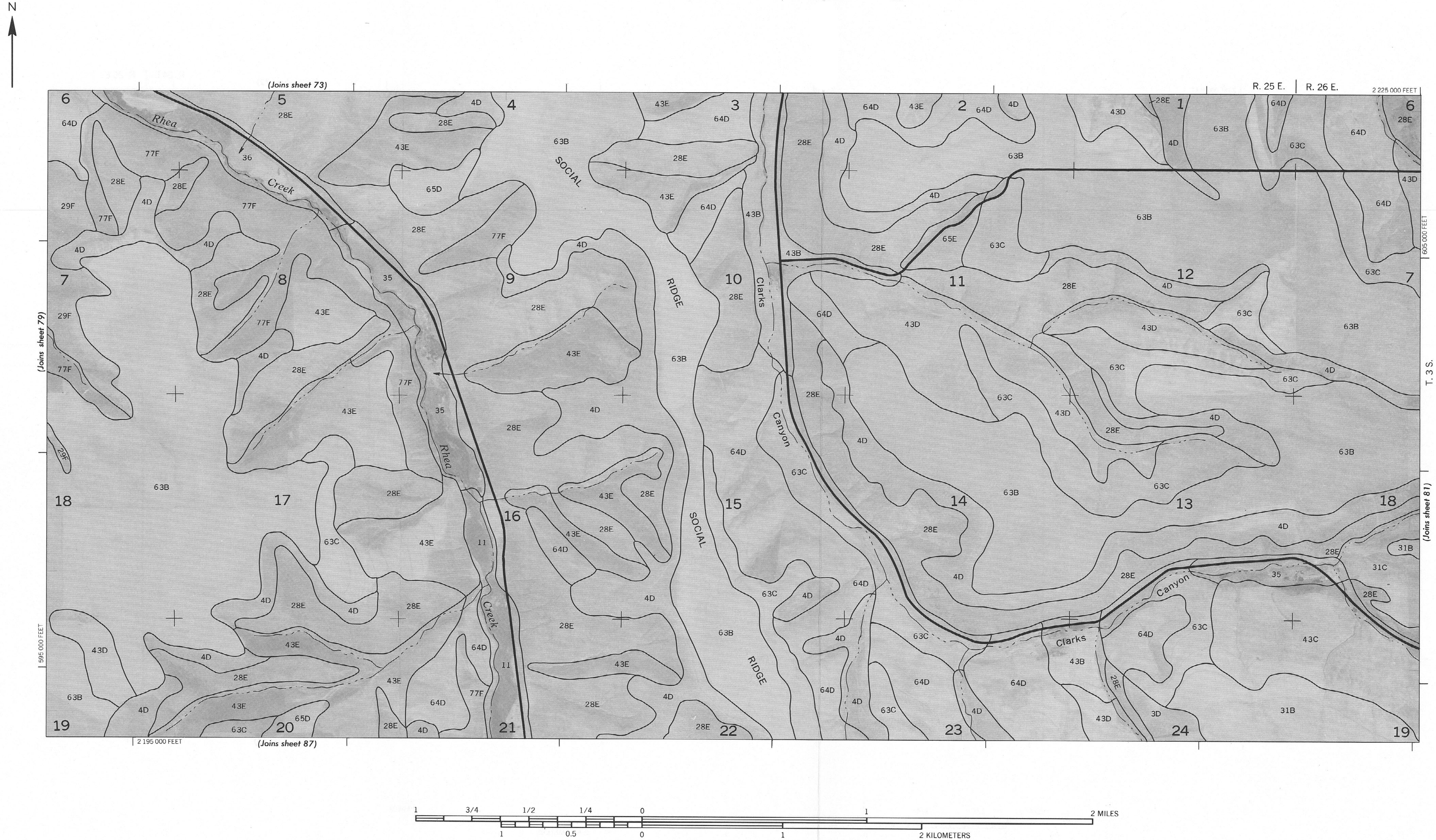
MORROW COUNTY, OREGON — SHEET NUMBER 79

MORROW COUNTY, OREGON NO. 79

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
R. 24 E.
R. 25 E.
T. 3 S.
(Joins sheet 72)
(Joins sheet 78)
(Joins sheet 80)
(Joins sheet 86)
2 165 000 FEET
2 190 000 FEET
605 000 FEET
595 000 FEET
Valby
JUNKINS CEMETERY
Lundell Canyon
Eightmile Canyon
Robinson Canyon
Huston Canyon
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
63B
63C
43C
43D
43E
28E
4D
64D
65D
65E
11
29F
77F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 80

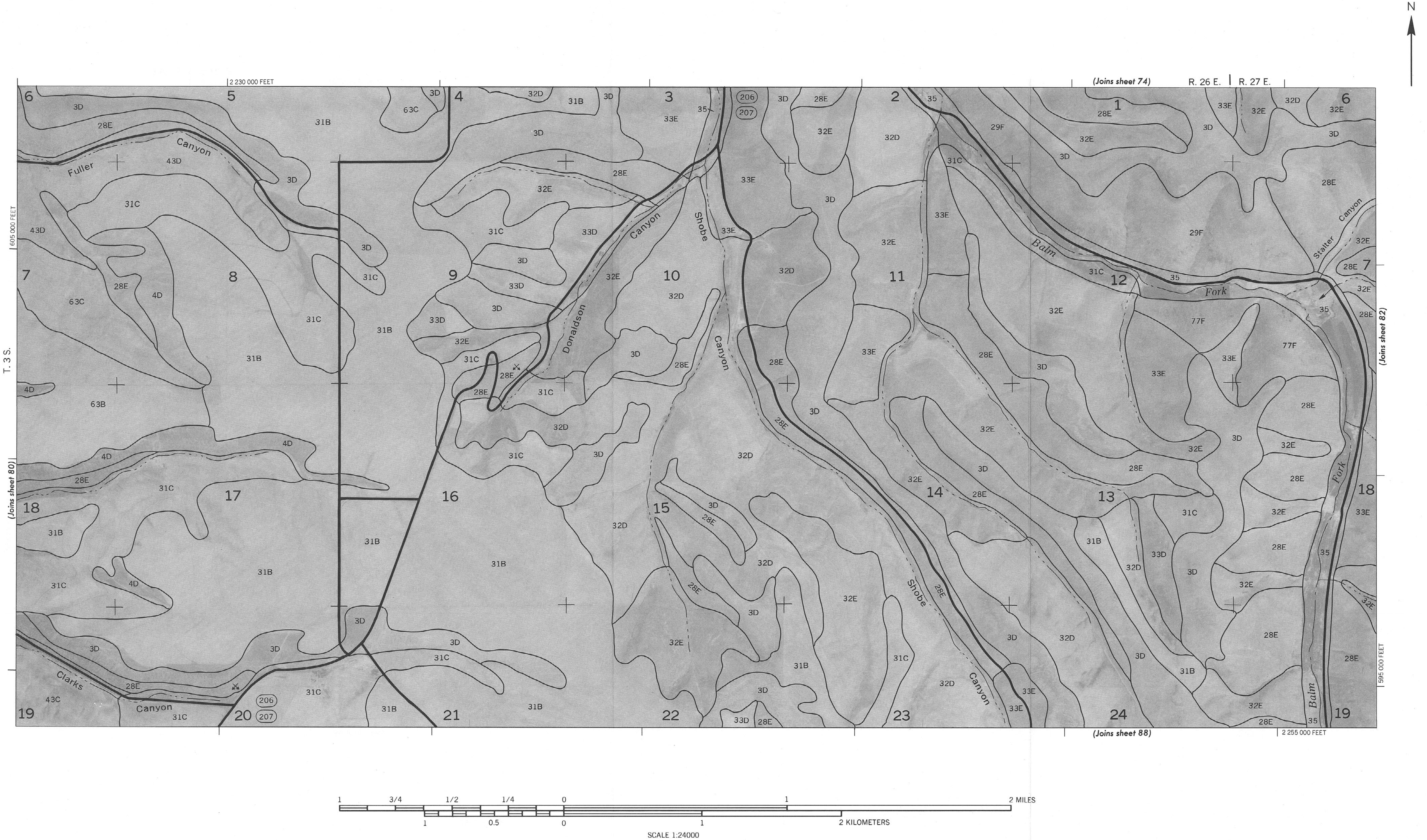

N
(Joins sheet 73)
(Joins sheet 79)
(Joins sheet 81)
(Joins sheet 87)
R. 25 E.
R. 26 E.
T. 3 S.
2 225 000 FEET
605 000 FEET
595 000 FEET
2 195 000 FEET
Rhea Creek
Rhea Creek
SOCIAL RIDGE
SOCIAL RIDGE
Clarks Canyon
Clarks Canyon
6
5
4
3
2
1
6
7
8
9
10
11
12
7
18
17
16
15
14
13
18
19
20
21
22
23
24
19
64D
28E
4D
43E
63B
77F
36
29F
65D
35
77F
43B
65E
63C
43D
11
31B
31C
3D
SCALE 1:24000
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 80

MORROW COUNTY, OREGON — SHEET NUMBER 81

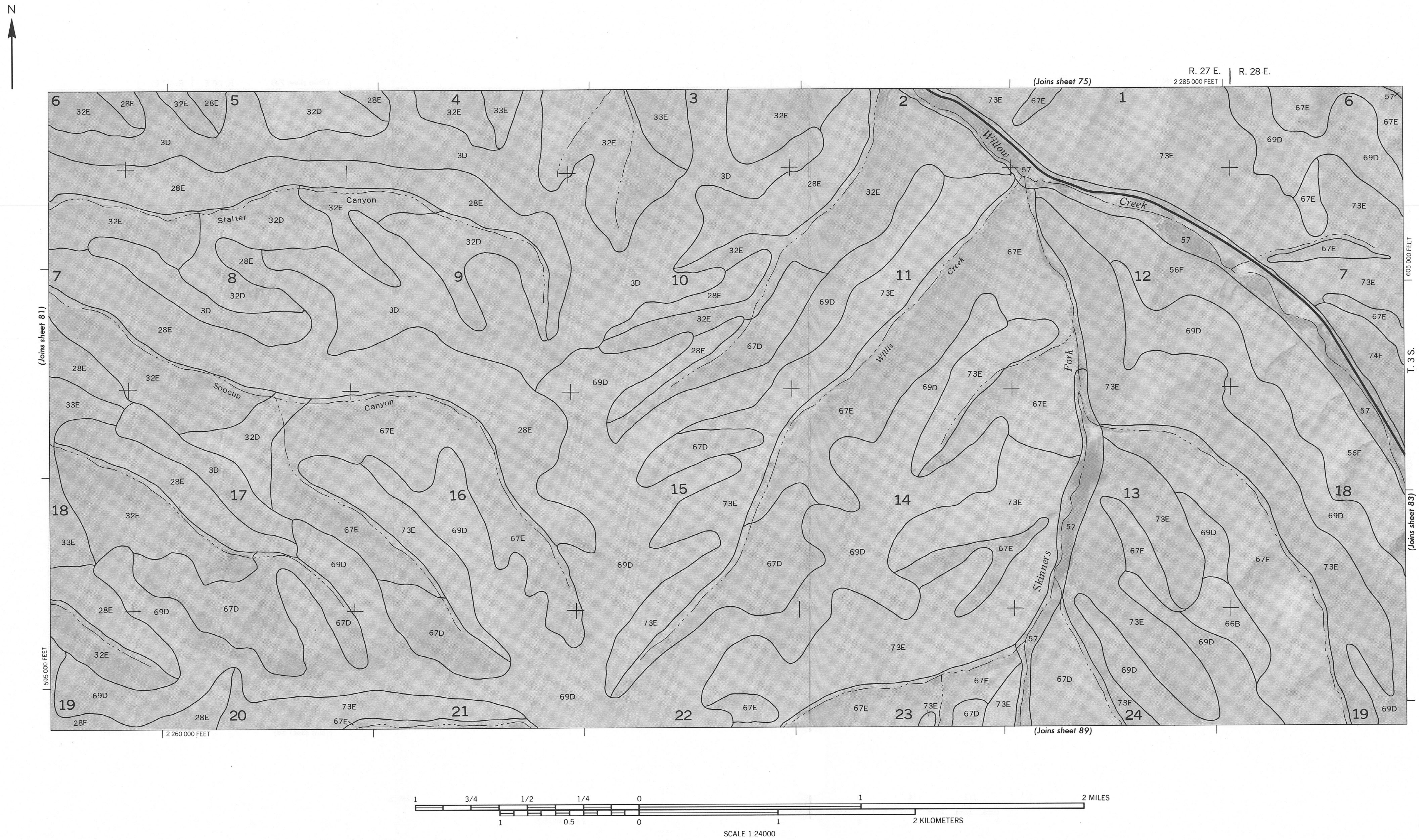
81


N
(Joins sheet 74)
R. 26 E.
R. 27 E.
2 230 000 FEET
605 000 FEET
T. 3 S.
(Joins sheet 80)
(Joins sheet 82)
(Joins sheet 88)
595 000 FEET
2 255 000 FEET
Fuller Canyon
Clarks Canyon
Donaldson Canyon
Shobe Canyon
Balm Fork
Statter Canyon
206
207
6
5
4
3
2
1
7
8
9
10
11
12
18
17
16
15
14
13
19
20
21
22
23
24
SCALE 1:24000
1
3/4
1/2
1/4
0
2 MILES
0.5
2 KILOMETERS

MORROW COUNTY, OREGON NO. 81

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MORROW COUNTY, OREGON — SHEET NUMBER 82


N
R. 27 E.
R. 28 E.
(Joins sheet 75)
2 285 000 FEET
(Joins sheet 81)
(Joins sheet 83)
(Joins sheet 89)
605 000 FEET
595 000 FEET
2 260 000 FEET
T. 3 S.
6
5
4
3
2
1
7
8
9
10
11
12
18
17
16
15
14
13
19
20
21
22
23
24
Stalter
Canyon
Soocup
Canyon
Willow
Creek
Willis
Creek
Fork
Skinners
3D
28E
32D
32E
33E
56F
57
66B
67D
67E
69D
73E
74F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

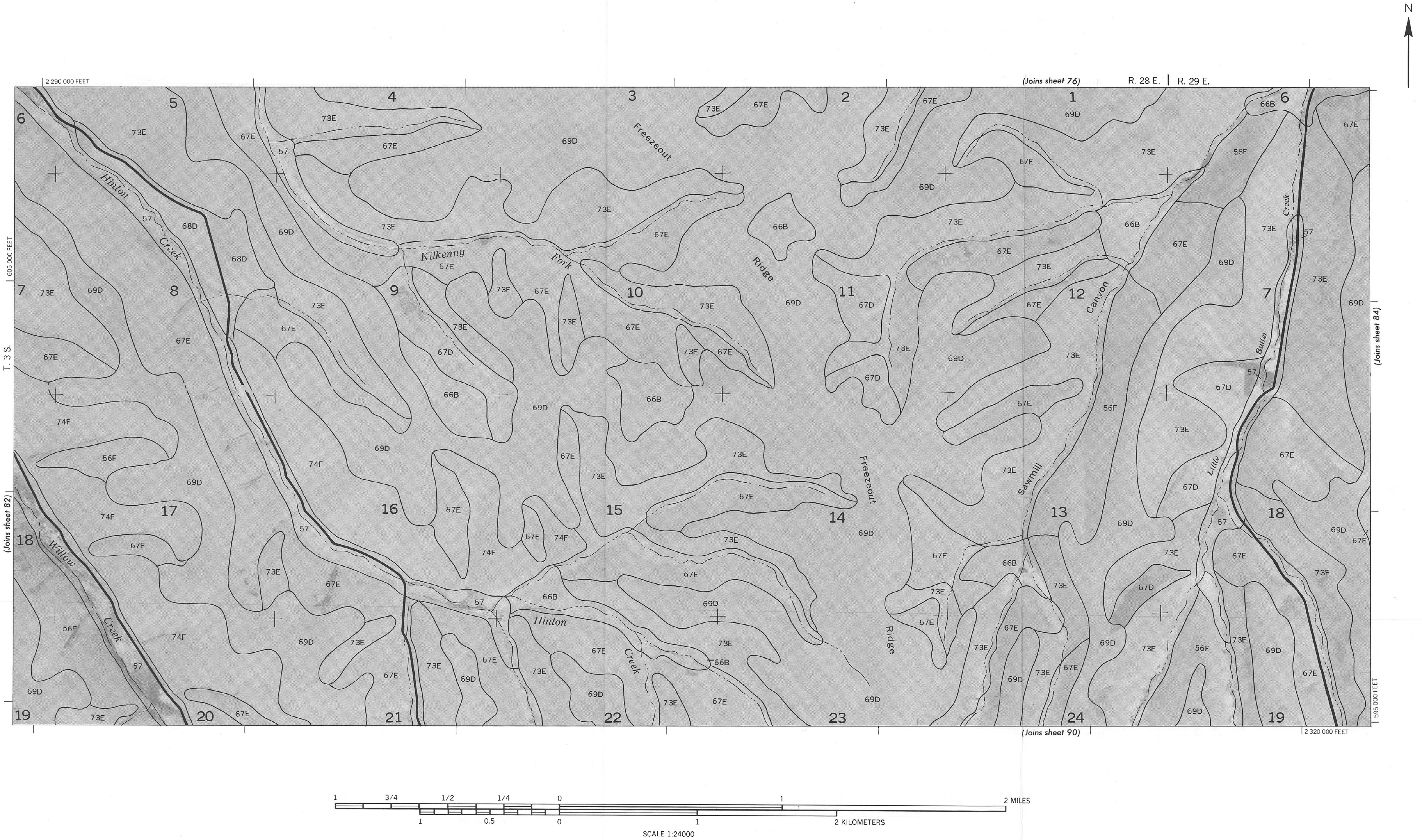
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON — SHEET NUMBER 83

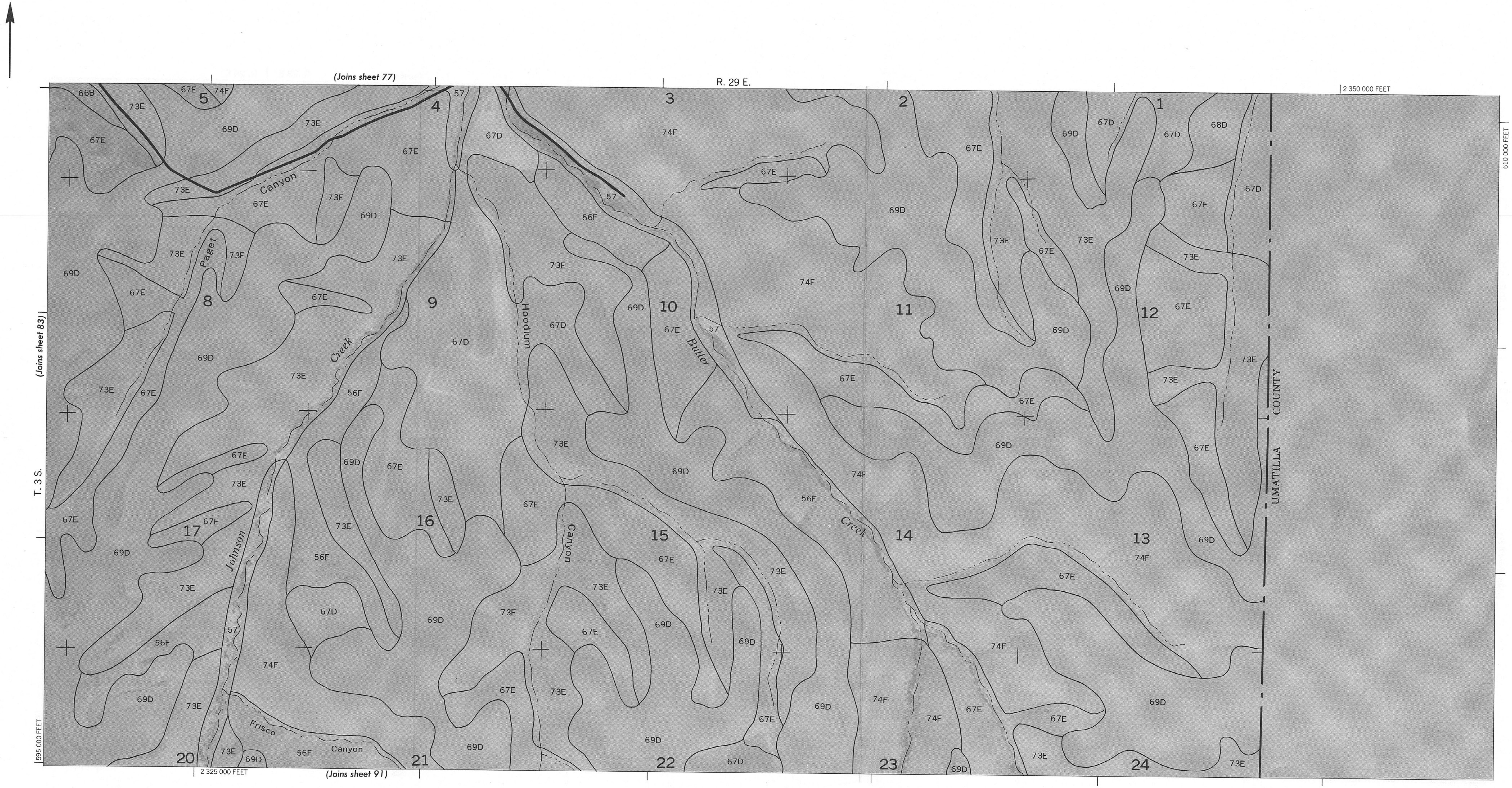
⑧③

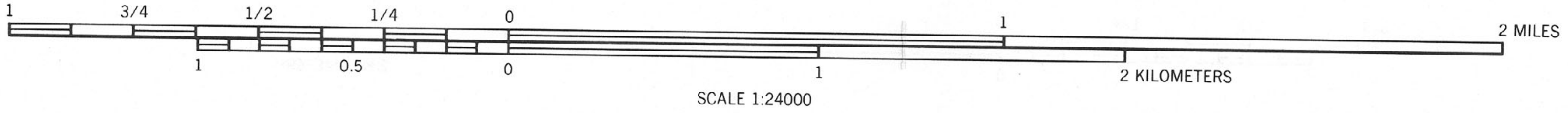
MORROW COUNTY, OREGON NO. 83

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
2 290 000 FEET
(Joins sheet 76)
R. 28 E.
R. 29 E.
605 000 FEET
T. 3 S.
(Joins sheet 82)
(Joins sheet 84)
595 000 FEET
(Joins sheet 90)
2 320 000 FEET
Hinton Creek
Kilkenny Fork
Freezeout Ridge
Canyon
Butter Creek
Little Butter Creek
Sawmill Canyon
Willow Creek
6
5
4
3
2
1
7
8
9
10
11
12
18
17
16
15
14
13
19
20
21
22
23
24
56F
57
66B
67D
67E
68D
69D
73E
74F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 84


N
(Joins sheet 77)
R. 29 E.
2 350 000 FEET
610 000 FEET
(Joins sheet 83)
T. 3 S.
595 000 FEET
2 325 000 FEET
(Joins sheet 91)
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
20
21
22
23
24
Canyon
Paget
Creek
Johnson
Frisco
Canyon
Hoodlum
Canyon
Butter
Creek
UMATILLA
COUNTY
66B
73E
67E
74F
69D
67E
57
67D
74F
68D
67D
56F
73E
69D
69D
67E
73E
67D
57
56F
74F
74F
57
56F
73E
69D
69D


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

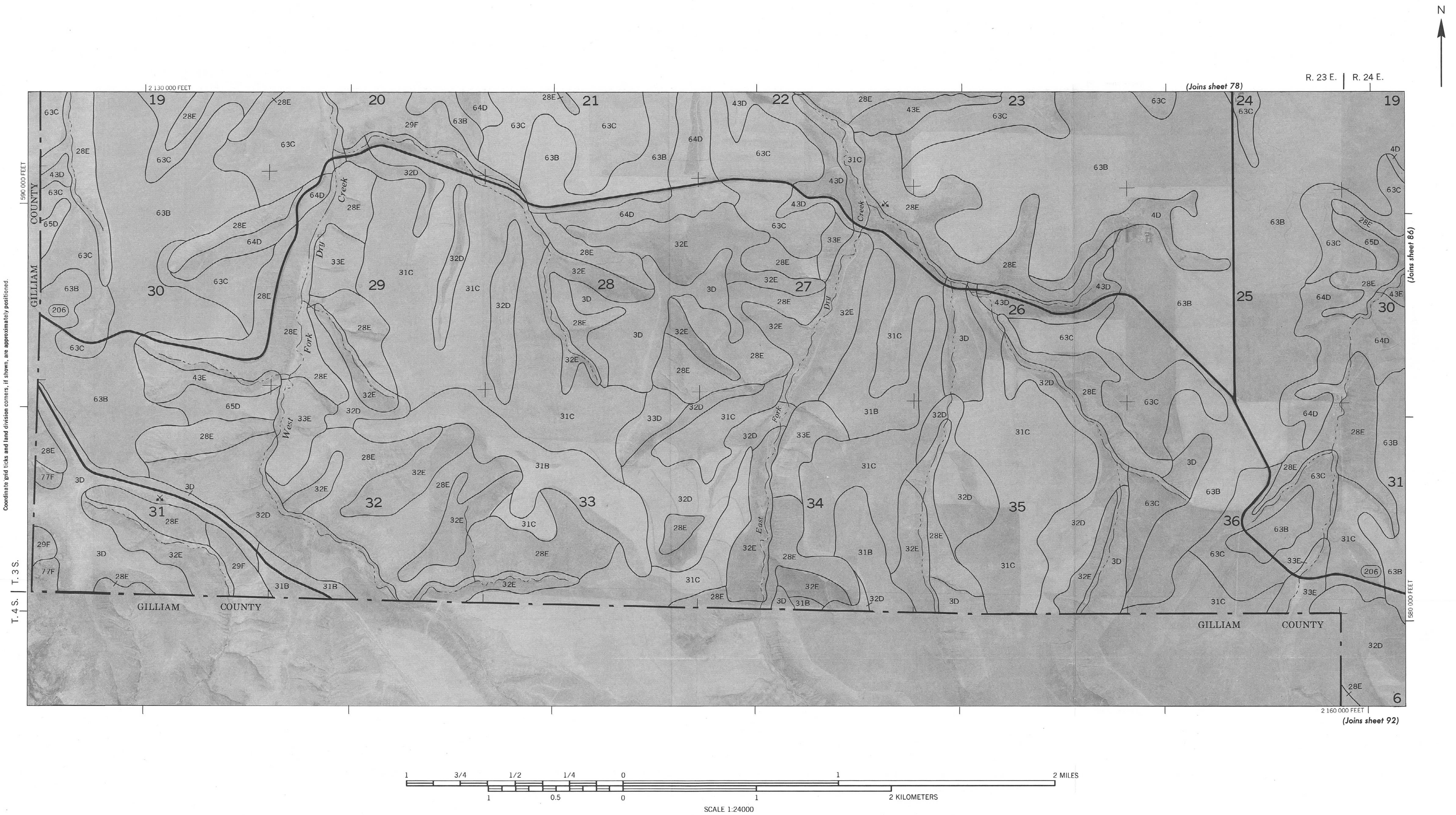
Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 84

MORROW COUNTY, OREGON — SHEET NUMBER 85

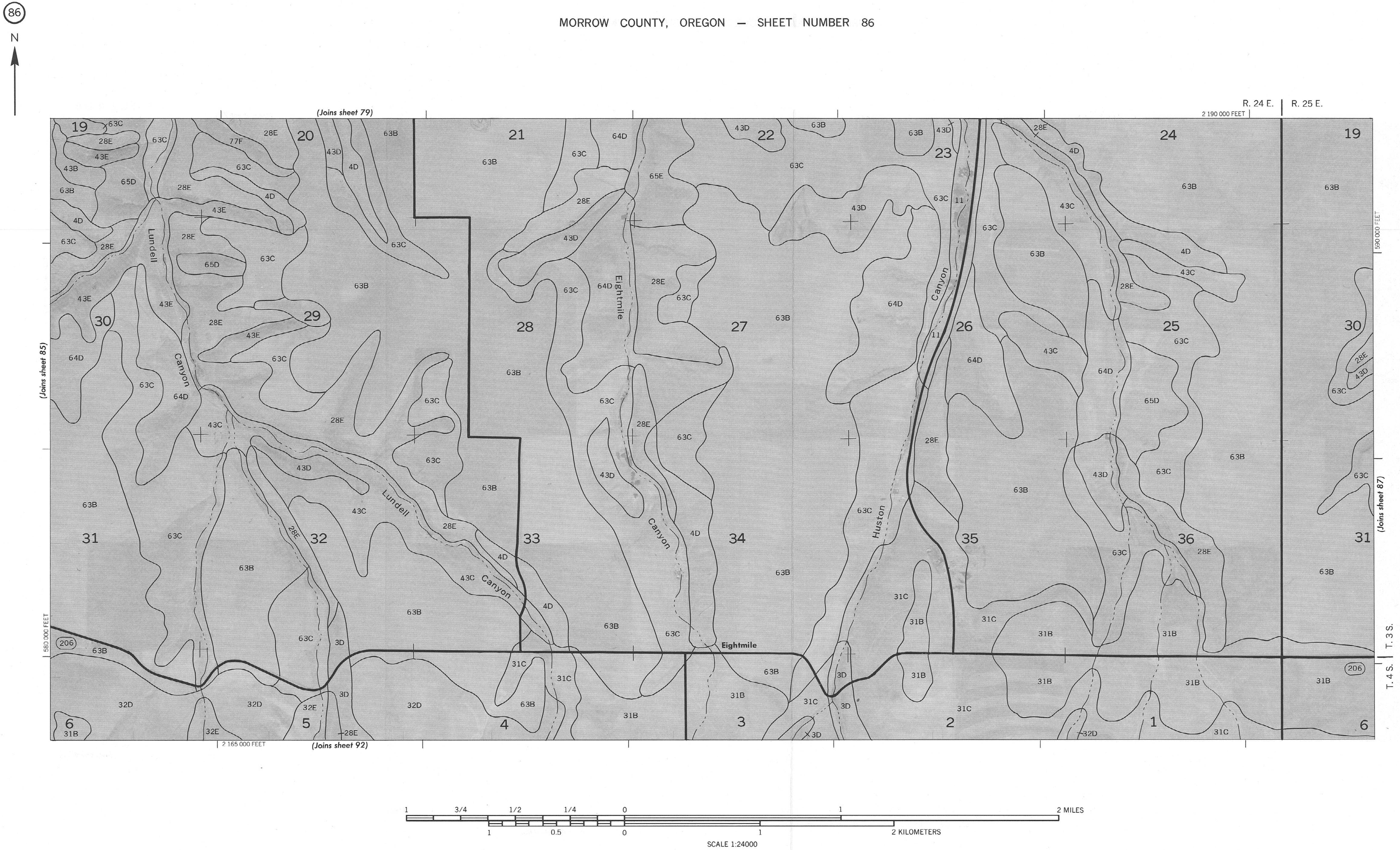
MORROW COUNTY, OREGON NO. 85

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



85
N
R. 23 E.
R. 24 E.
(Joins sheet 78)
(Joins sheet 86)
(Joins sheet 92)
2 130 000 FEET
2 160 000 FEET
590 000 FEET
580 000 FEET
T. 4 S.
T. 3 S.
GILLIAM COUNTY
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
6
West Fork Dry Creek
East Fork Dry Creek
206
63C
28E
63B
43D
65D
64D
33E
31C
32D
31B
32E
3D
43E
29F
77F
4D
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

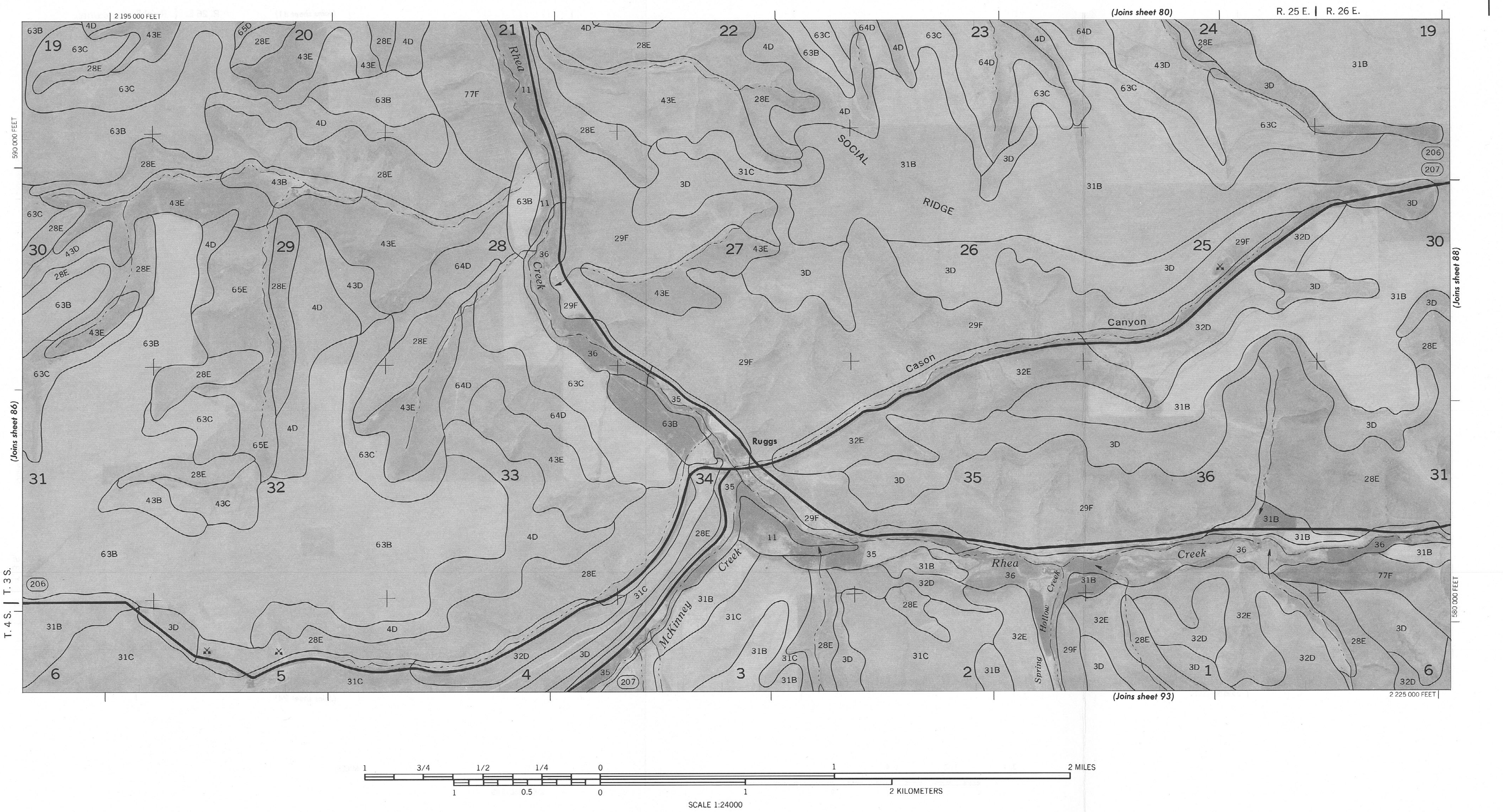
MORROW COUNTY, OREGON — SHEET NUMBER 86


N
(Joins sheet 79)
(Joins sheet 85)
(Joins sheet 87)
(Joins sheet 92)
R. 24 E.
R. 25 E.
T. 3 S.
T. 4 S.
2 190 000 FEET
2 165 000 FEET
590 000 FEET
580 000 FEET
19
20
21
22
23
24
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
Lundell Canyon
Eightmile Canyon
Huston Canyon
Canyon
Eightmile
206
11
63C
28E
43E
43B
63B
65D
4D
77F
43D
64D
65E
43C
64D
31C
31B
32D
32E
3D
1
3/4
1/2
1/4
0
2 MILES
0.5
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 86

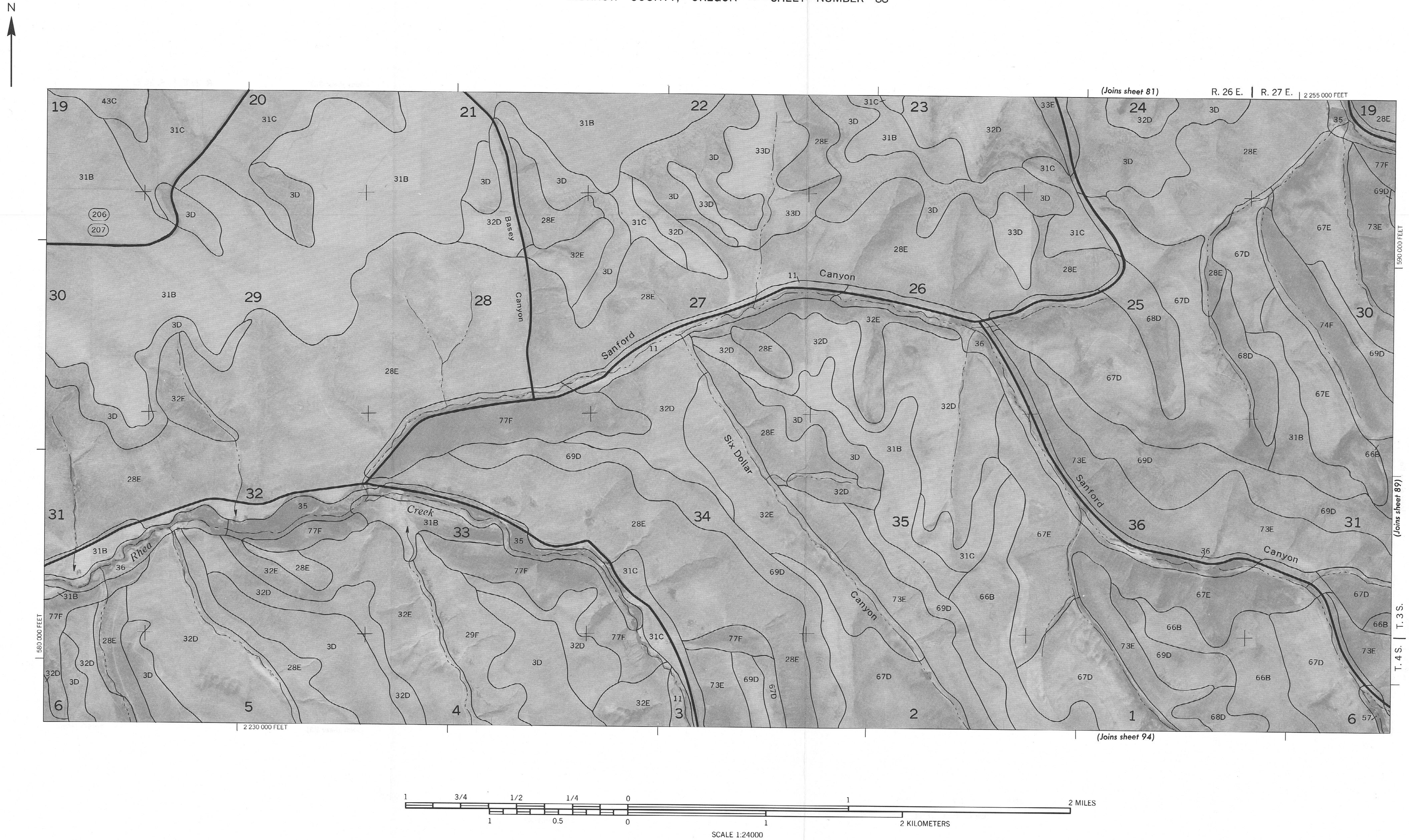
MORROW COUNTY, OREGON — SHEET NUMBER 87


(Joins sheet 80)
R. 25 E. | R. 26 E.
N
2 195 000 FEET
590 000 FEET
(Joins sheet 86)
(Joins sheet 88)
(Joins sheet 93)
580 000 FEET
2 225 000 FEET
T. 3 S.
T. 4 S.
206
207
Rhea Creek
SOCIAL RIDGE
Cason Canyon
Ruggs
McKinney Creek
Spring Hollow Creek
19
20
21
22
23
24
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
63B
63C
28E
43E
4D
65D
77F
11
29F
3D
31B
31C
32D
32E
36
35
64D
43D
43B
43C
65E
SCALE 1:24000
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

MORROW COUNTY, OREGON NO. 87

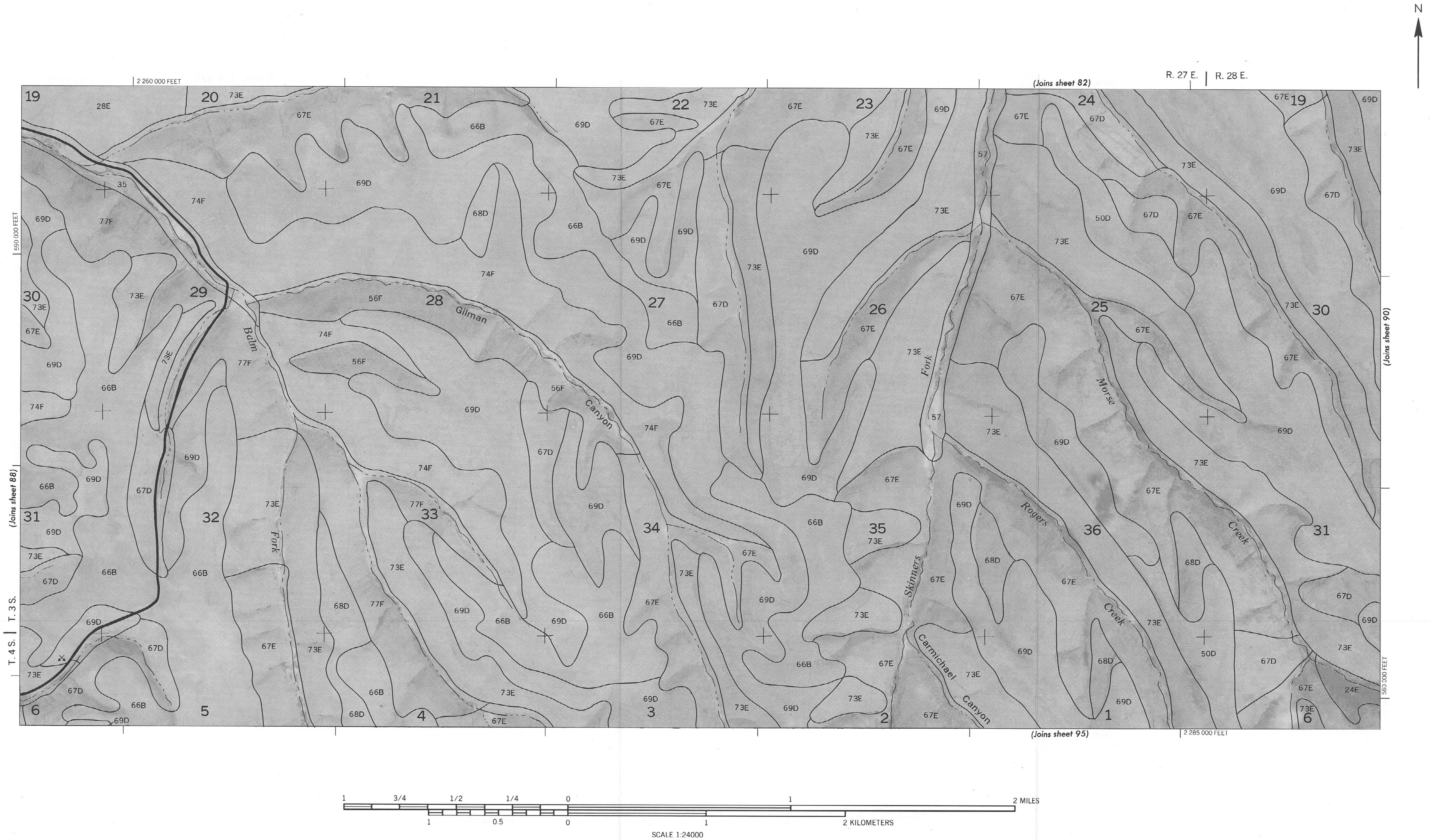
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MORROW COUNTY, OREGON — SHEET NUMBER 88


N
(Joins sheet 81)
R. 26 E.
R. 27 E.
2 255 000 FEET
590 000 FEET
(Joins sheet 89)
T. 3 S.
T. 4 S.
(Joins sheet 94)
2 230 000 FEET
580 000 FEET
19
20
21
22
23
24
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
206
207
Basey Canyon
Sanford Canyon
Six Dollar Canyon
Rhea Creek
43C
31C
31B
3D
32D
28E
32E
33D
33E
11
35
36
77F
69D
73E
67D
67E
68D
74F
66B
29F
57
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

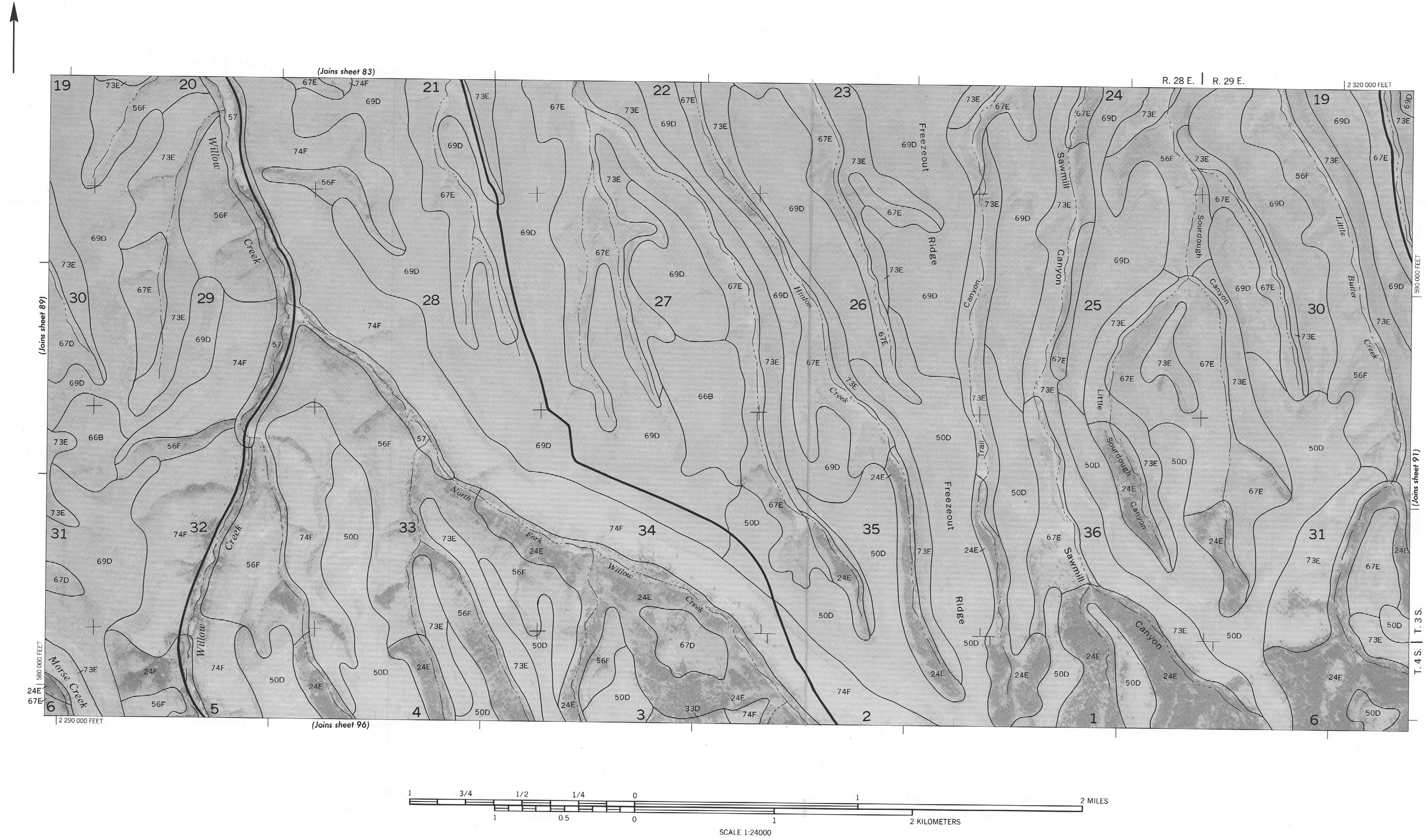
MORROW COUNTY, OREGON — SHEET NUMBER 89


N
2 260 000 FEET
(Joins sheet 82)
R. 27 E.
R. 28 E.
590 000 FEET
(Joins sheet 88)
(Joins sheet 90)
(Joins sheet 95)
2 285 000 FEET
580 000 FEET
T. 3 S.
T. 4 S.
19
28E
20
73E
21
67E
66B
69D
22
73E
67E
67E
23
69D
24
67D
67E
19
69D
35
77F
74F
69D
68D
73E
67E
69D
69D
66B
73E
57
73E
50D
67D
67E
73E
69D
67D
73E
30
73E
67E
73E
29
56F
28
Gilman
74F
27
66B
67D
69D
26
67E
73E
67E
25
67E
73E
30
67E
69D
66B
73E
Balm
77F
74F
56F
69D
56F
Canyon
74F
Fork
57
73E
69D
Morse
69D
74F
31
66B
69D
67D
69D
74F
67D
69D
67E
73E
67E
31
69D
32
73E
77F
33
69D
34
66B
35
73E
Rogers
36
Creek
73E
67D
66B
66B
Fork
73E
67E
73E
69D
68D
67E
68D
67E
68D
69D
68D
77F
69D
66B
69D
66B
67E
69D
73E
Skinners
Creek
73E
67D
69D
67D
67E
73E
66B
67E
Carmichael
Canyon
73E
69D
50D
73E
67D
66B
68D
73E
73E
24E
67E
6
69D
5
4
67E
3
69D
73E
69D
73E
2
67E
1
69D
73E
6
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON NO. 89

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MORROW COUNTY, OREGON — SHEET NUMBER 90


N
(Joins sheet 83)
(Joins sheet 89)
(Joins sheet 91)
(Joins sheet 96)
R. 28 E.
R. 29 E.
T. 3 S.
T. 4 S.
2 320 000 FEET
590 000 FEET
580 000 FEET
2 290 000 FEET
19
20
21
22
23
24
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
Willow Creek
North Fork Willow Creek
Morse Creek
Hinton Creek
Freezeout Ridge
Freezeout Canyon
Sawmill Canyon
Little Sawmill Canyon
Sourdough Canyon
Little Sourdough Canyon
Little Butter Creek
Trail Canyon
24E
24F
33D
50D
56F
57
66B
67D
67E
69D
73E
74F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

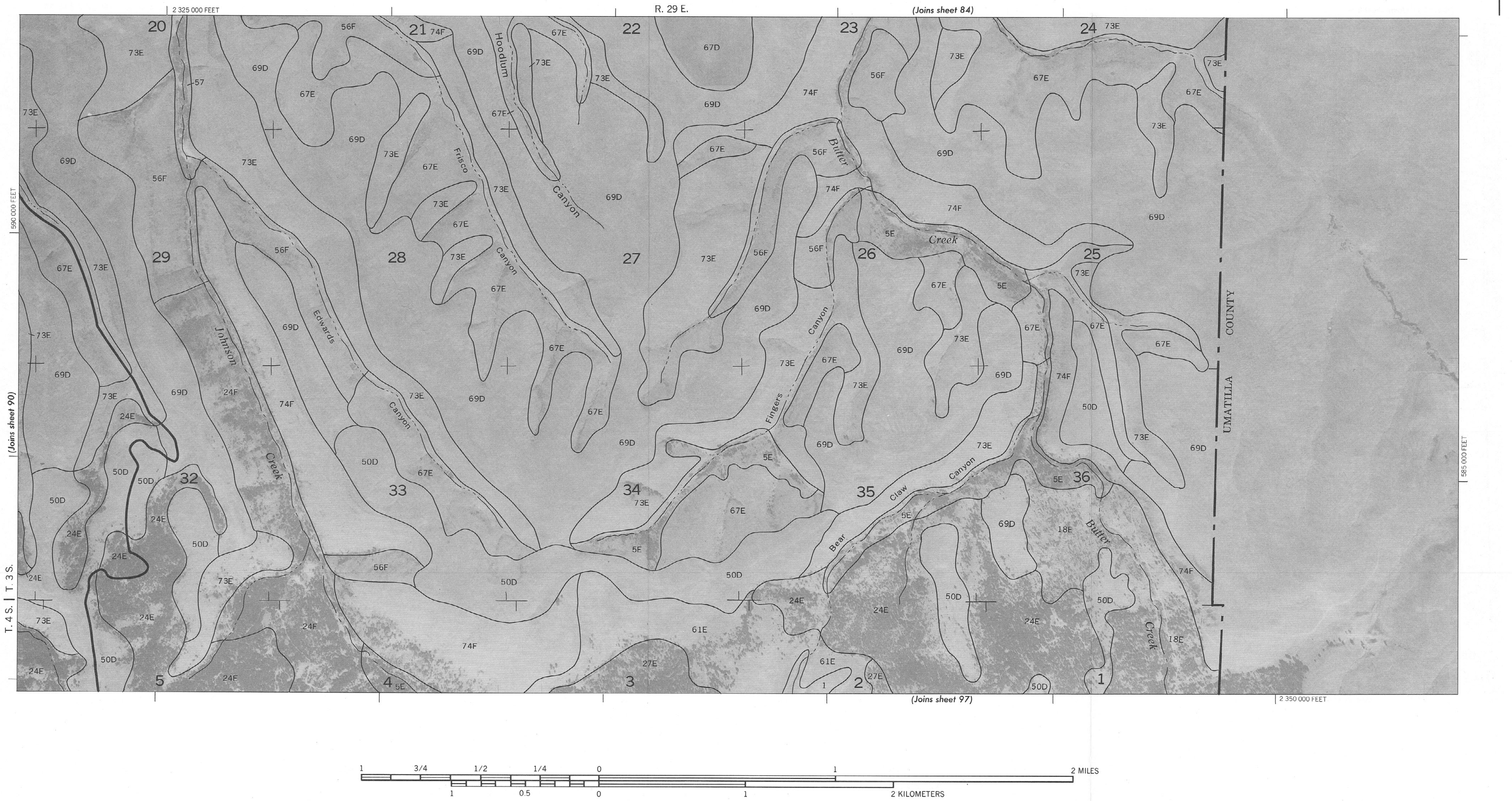
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 90

MORROW COUNTY, OREGON — SHEET NUMBER 91

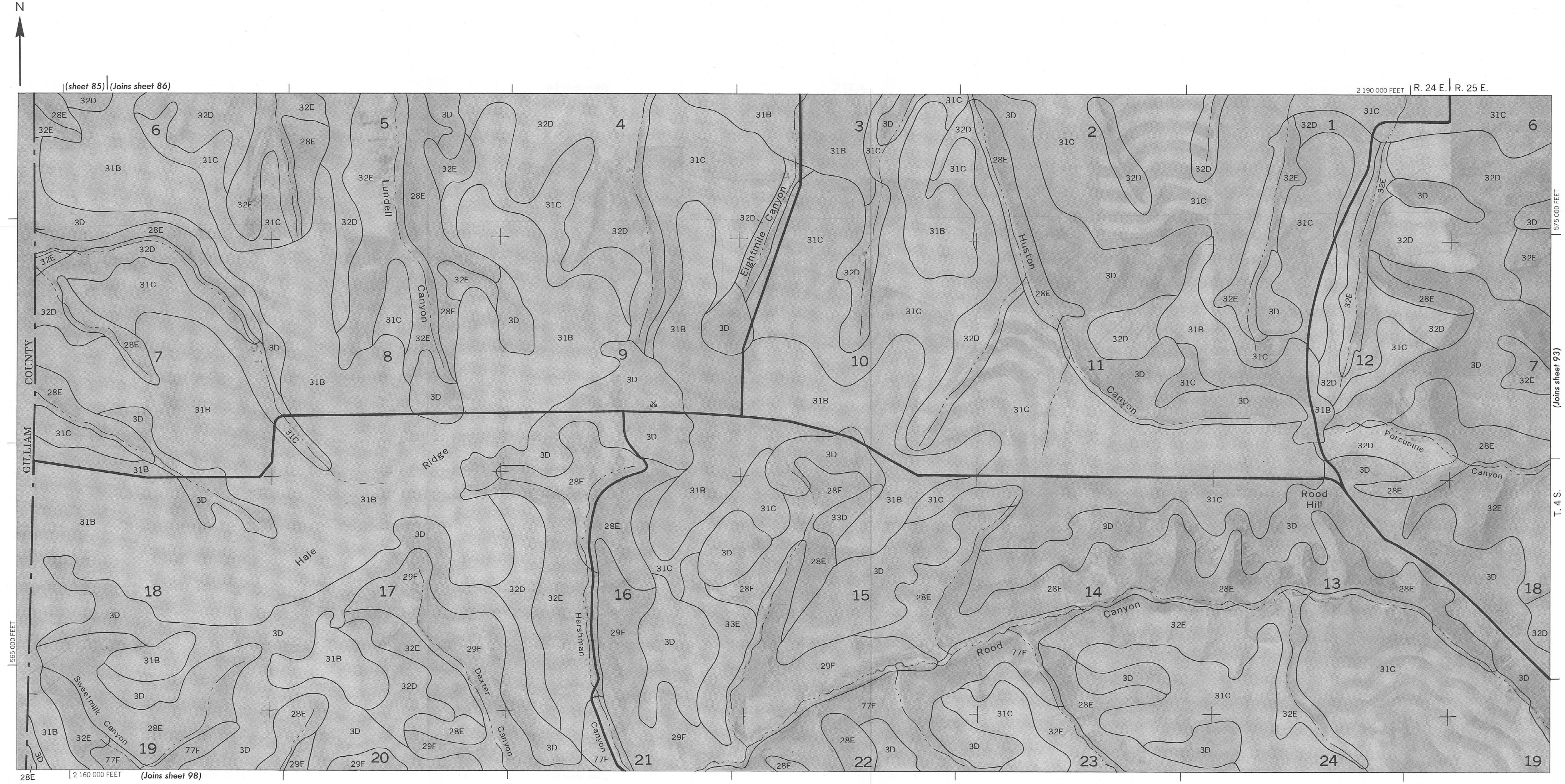
MORROW COUNTY, OREGON NO. 91

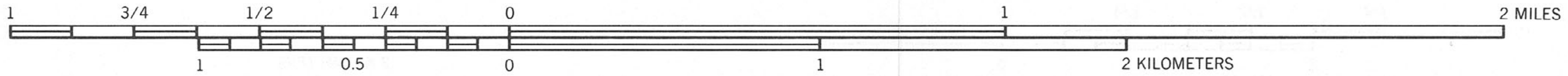
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
2 325 000 FEET
R. 29 E.
(Joins sheet 84)
(Joins sheet 90)
(Joins sheet 97)
590 000 FEET
585 000 FEET
2 350 000 FEET
T. 3 S.
T. 4 S.
UMATILLA COUNTY
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
5
4
3
2
1
Johnson Creek
Edwards Canyon
Frisco Canyon
Hoodlum Canyon
Butter Creek
Fingers Canyon
Bear Claw Canyon
73E
69D
56F
67E
74F
67D
57
5E
50D
24E
24F
61E
27E
18E
1
2 MILES
3/4
1/2
1/4
0
1
2 KILOMETERS
0.5

SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 92


N
(sheet 85)
(Joins sheet 86)
2 190 000 FEET
R. 24 E.
R. 25 E.
575 000 FEET
(Joins sheet 93)
T. 4 S.
565 000 FEET
2 160 000 FEET
(Joins sheet 98)
GILLIAM COUNTY
Lundell Canyon
Eightmile Canyon
Huston Canyon
Porcupine Canyon
Hale Ridge
Harshman Canyon
Dexter Canyon
Sweetmilk Canyon
Rood Canyon
Rood Hill
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
3D
28E
29F
31B
31C
32D
32E
33D
33E
77F


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

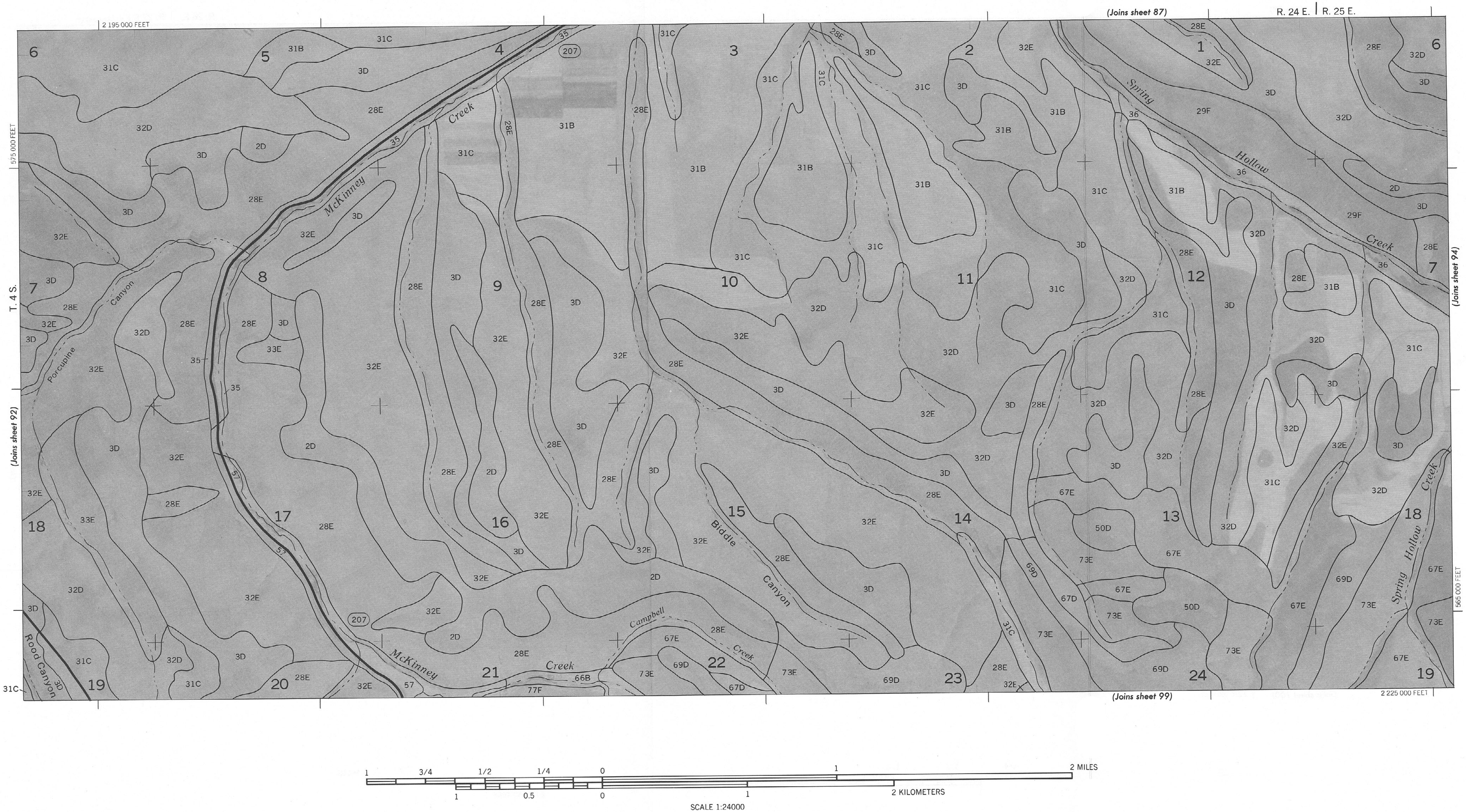
MORROW COUNTY, OREGON NO. 92

93

MORROW COUNTY, OREGON — SHEET NUMBER 93

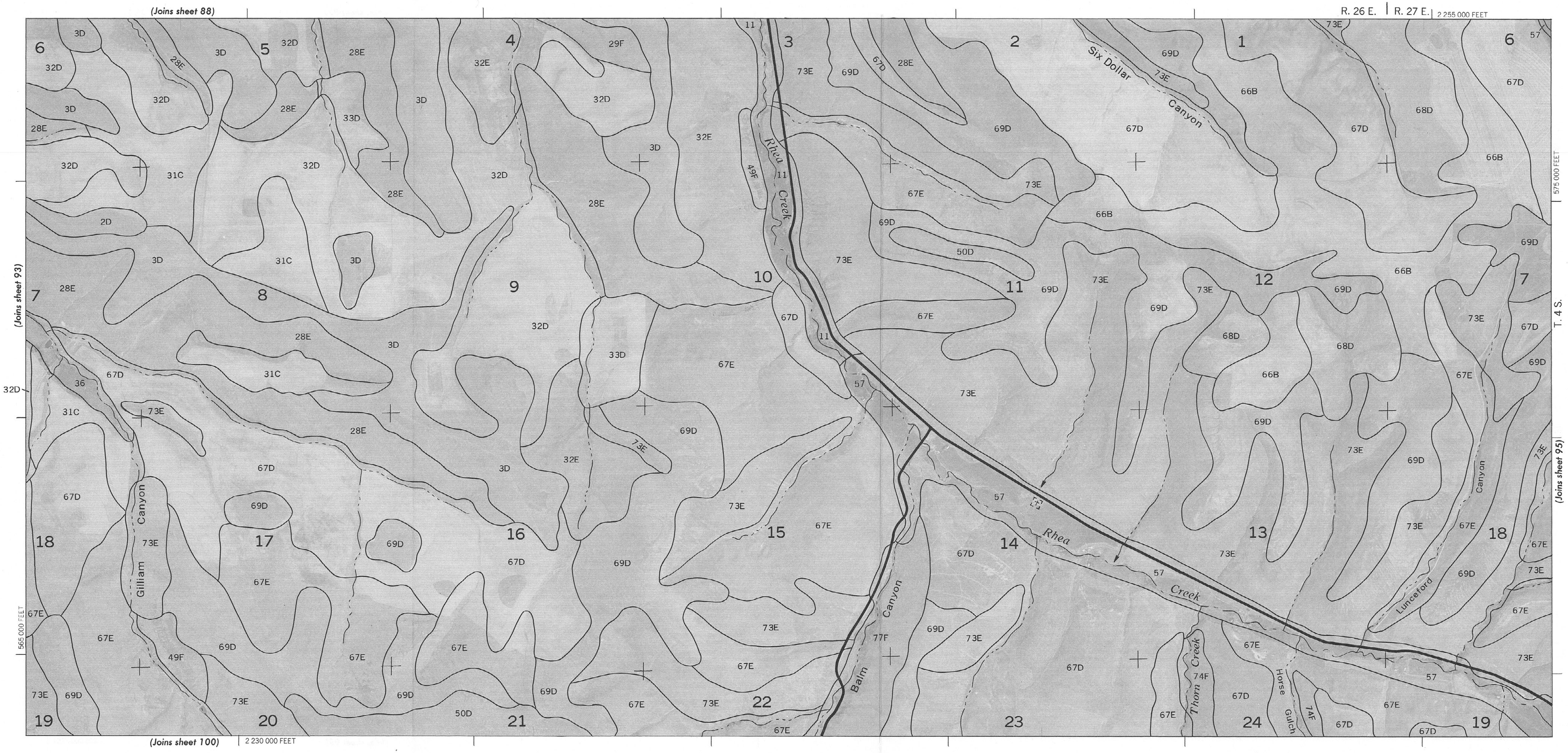
MORROW COUNTY, OREGON NO. 93

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


(Joins sheet 87)
R. 24 E.
R. 25 E.
2 195 000 FEET
575 000 FEET
T. 4 S.
(Joins sheet 92)
(Joins sheet 94)
(Joins sheet 99)
565 000 FEET
2 225 000 FEET
N
McKinney Creek
Porcupine Canyon
Rood Canyon
Biddle Canyon
Campbell Creek
Spring Hollow Creek
207
35
57
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
2D
3D
28E
29F
31B
31C
32D
32E
32F
33E
36
50D
57
66B
67D
67E
69D
73E
77F
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

N

MORROW COUNTY, OREGON — SHEET NUMBER 94


(Joins sheet 88)
R. 26 E.
R. 27 E.
2 255 000 FEET
575 000 FEET
T. 4 S.
(Joins sheet 95)
(Joins sheet 93)
565 000 FEET
(Joins sheet 100)
2 230 000 FEET
Six Dollar Canyon
Rhea Creek
Gilliam Canyon
Balm Canyon
Thorn Creek
Horse Gulch
Lunceford Canyon
6
5
4
3
2
1
7
8
9
10
11
12
18
17
16
15
14
13
19
20
21
22
23
24
3D
32D
28E
29F
28E
32E
33D
3D
31C
2D
36
73E
67D
31C
28E
32D
33D
69D
67E
49F
11
57
50D
66B
68D
73E
67D
77F
74F
69D
67E

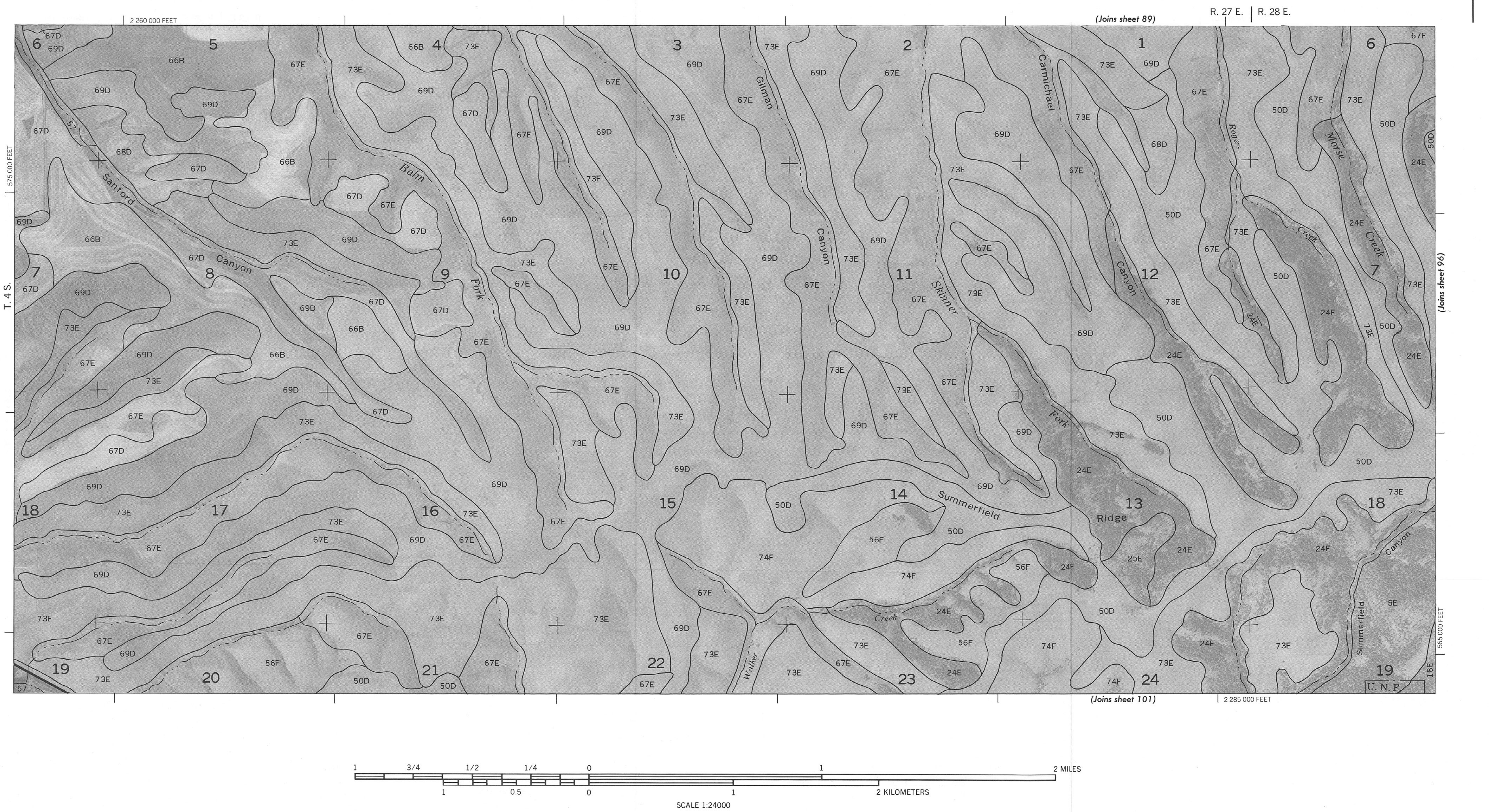
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 94

MORROW COUNTY, OREGON — SHEET NUMBER 95

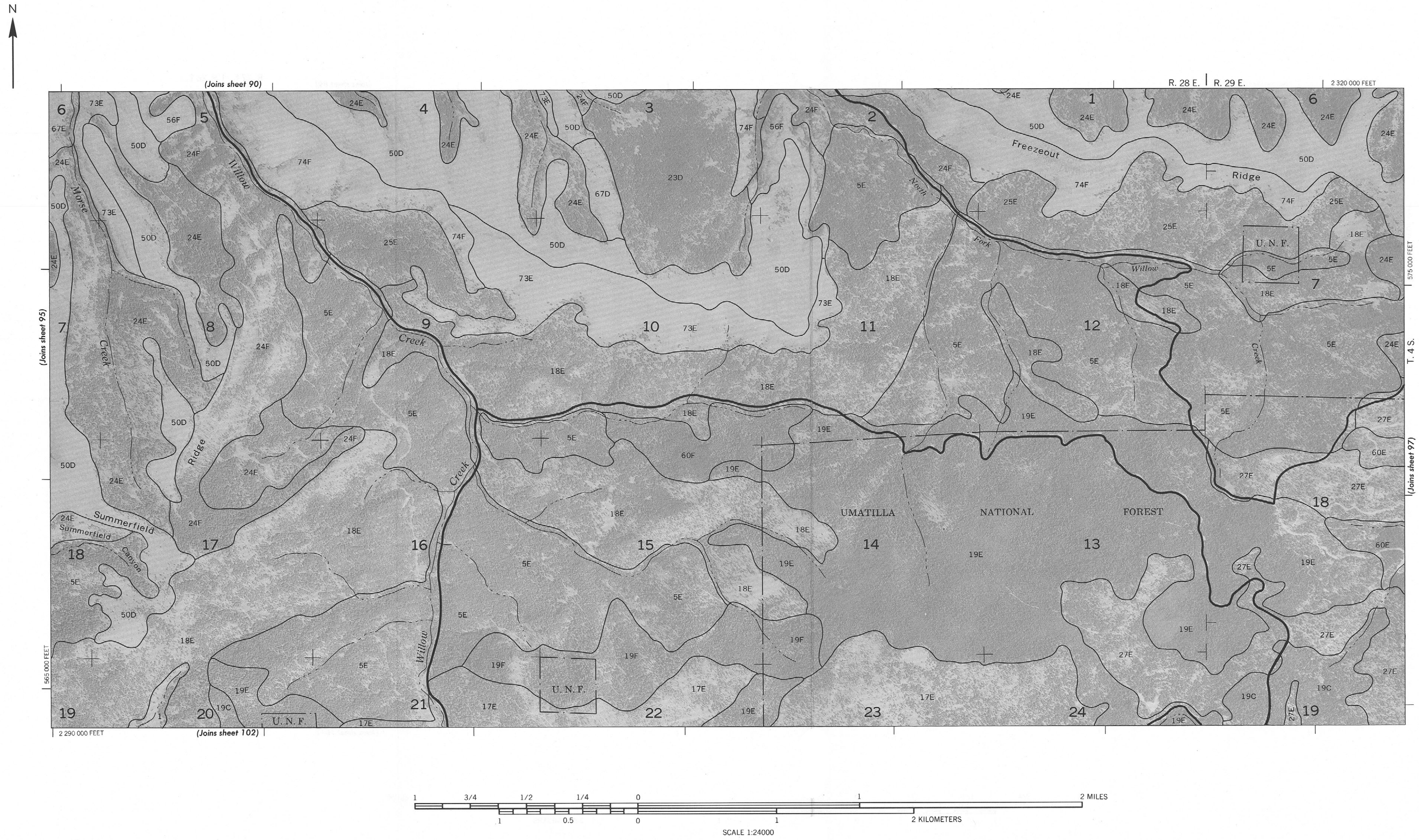


95
N
R. 27 E.
R. 28 E.
(Joins sheet 89)
(Joins sheet 96)
(Joins sheet 101)
2 260 000 FEET
2 285 000 FEET
575 000 FEET
565 000 FEET
T. 4 S.
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Sanford
Canyon
Balm
Fork
Gilman
Canyon
Carmichael
Canyon
Skinner
Fork
Rogers
Creek
Morse
Creek
Summerfield
Ridge
Walker
Creek
Summerfield
Canyon
U. N. F.
57
18E
5E
24E
25E
50D
56F
66B
67D
67E
68D
69D
73E
74F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON NO. 95

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MORROW COUNTY, OREGON — SHEET NUMBER 96


N
(Joins sheet 90)
(Joins sheet 95)
(Joins sheet 97)
(Joins sheet 102)
R. 28 E.
R. 29 E.
T. 4 S.
2 320 000 FEET
2 290 000 FEET
575 000 FEET
565 000 FEET
Willow Creek
Morse Creek
Ridge
Summerfield
Summerfield Canyon
Freezeout Ridge
North Fork Willow Creek
UMATILLA NATIONAL FOREST
U. N. F.
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

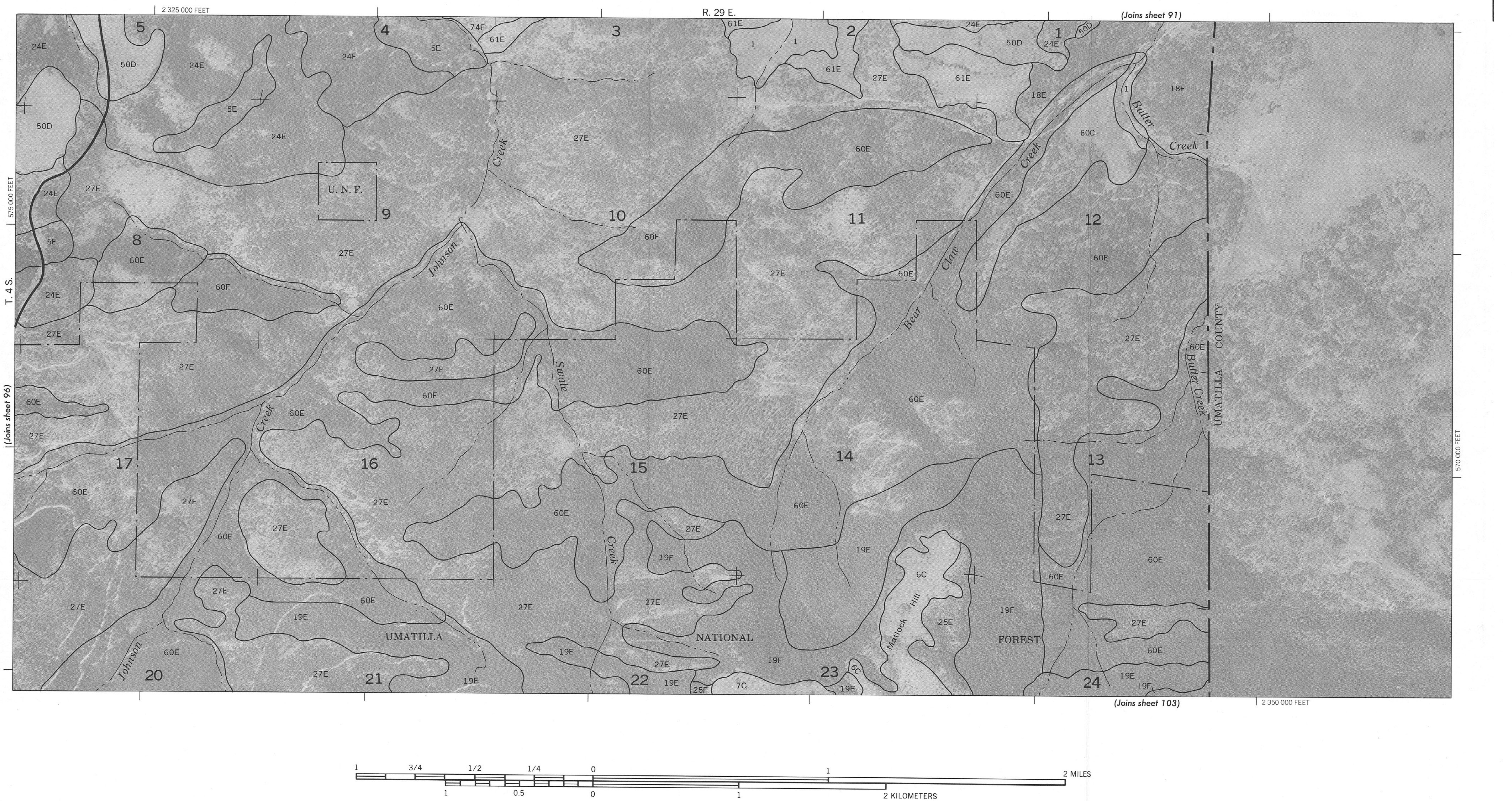
Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 96

MORROW COUNTY, OREGON — SHEET NUMBER 97

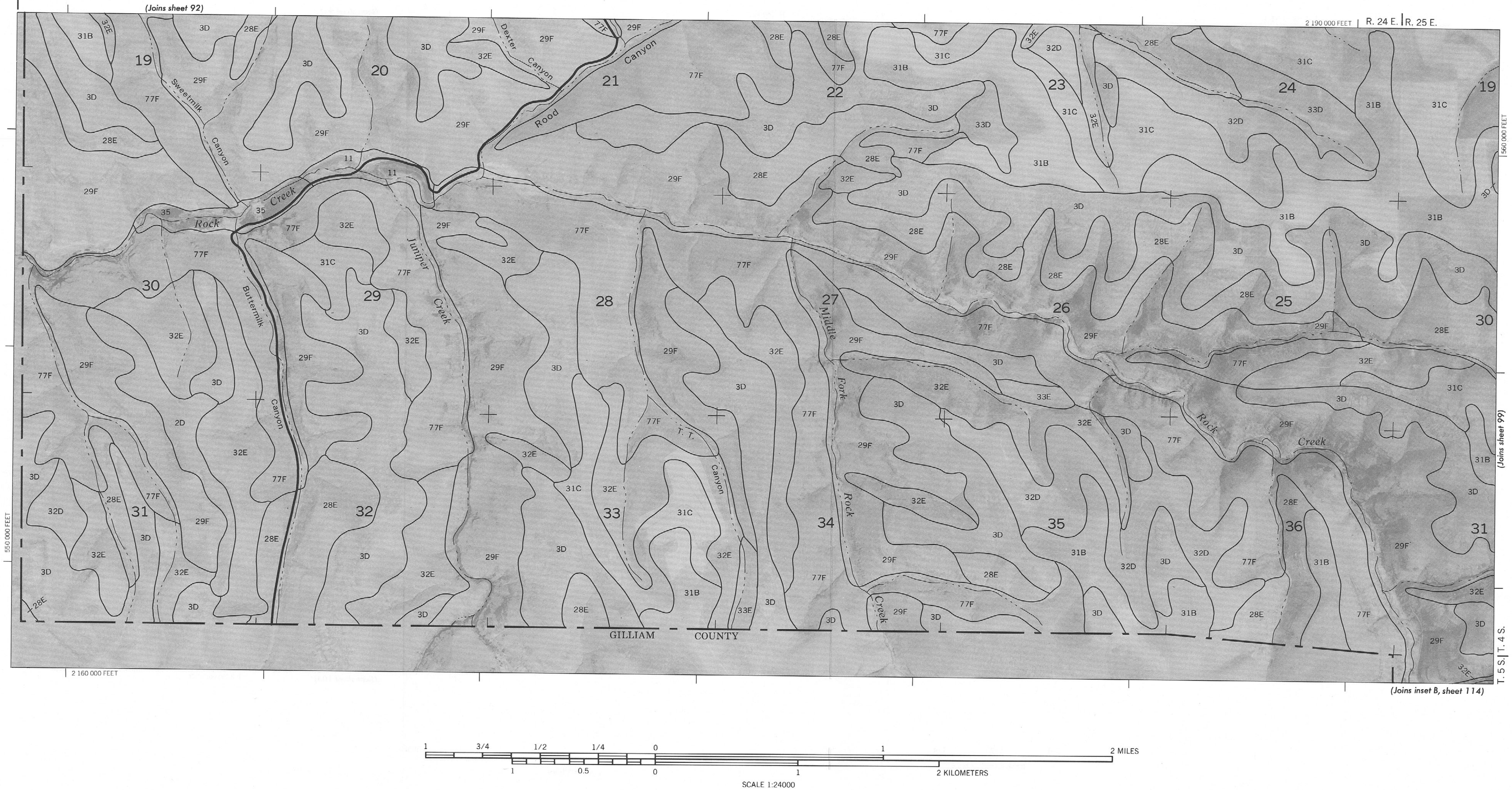
MORROW COUNTY, OREGON NO. 97

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
2 325 000 FEET
R. 29 E.
(Joins sheet 91)
575 000 FEET
T. 4 S.
(Joins sheet 96)
570 000 FEET
(Joins sheet 103)
2 350 000 FEET
5
4
3
2
1
74F
61E
5E
24E
24F
50D
1
61E
27E
61E
18E
18E
50D
24E
27E
60E
60C
U. N. F.
9
10
11
12
8
60E
24E
5E
60F
60E
Johnson
Creek
Butter
Creek
Bear
Claw
Swale
27E
60E
60F
17
16
15
14
13
19E
19F
6C
Mattock
Hill
25E
7C
25F
UMATILLA
NATIONAL
FOREST
UMATILLA COUNTY
20
21
22
23
24
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 98

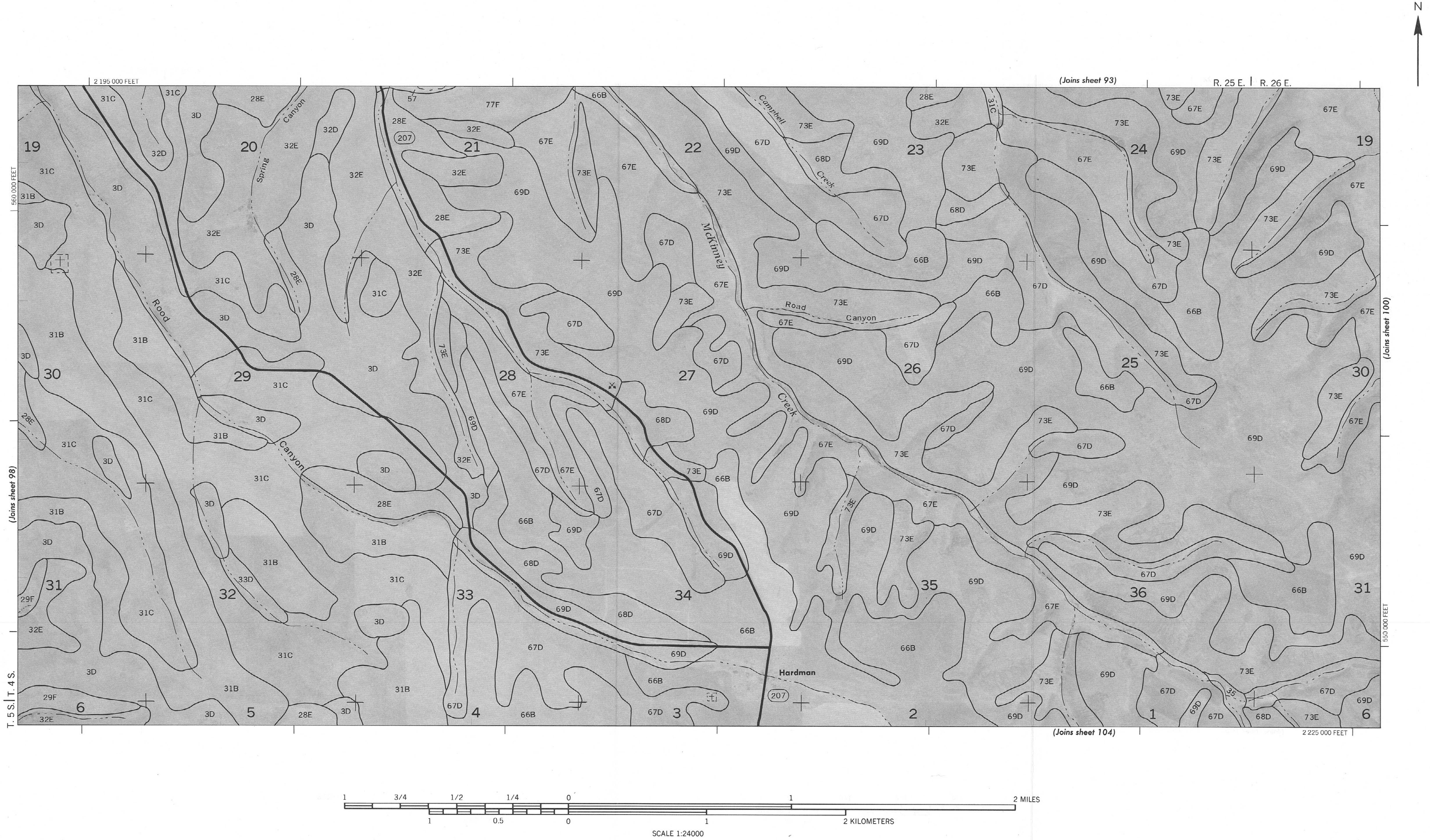

N
(Joins sheet 92)
(Joins sheet 99)
(Joins inset B, sheet 114)
2 190 000 FEET
2 160 000 FEET
560 000 FEET
550 000 FEET
R. 24 E.
R. 25 E.
T. 4 S.
T. 5 S.
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
Sweetmilk Canyon
Dexter Canyon
Rood Canyon
Rock Creek
Buttermilk Canyon
Juniper Creek
T. T. Canyon
Middle Fork Rock Creek
GILLIAM COUNTY
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 98

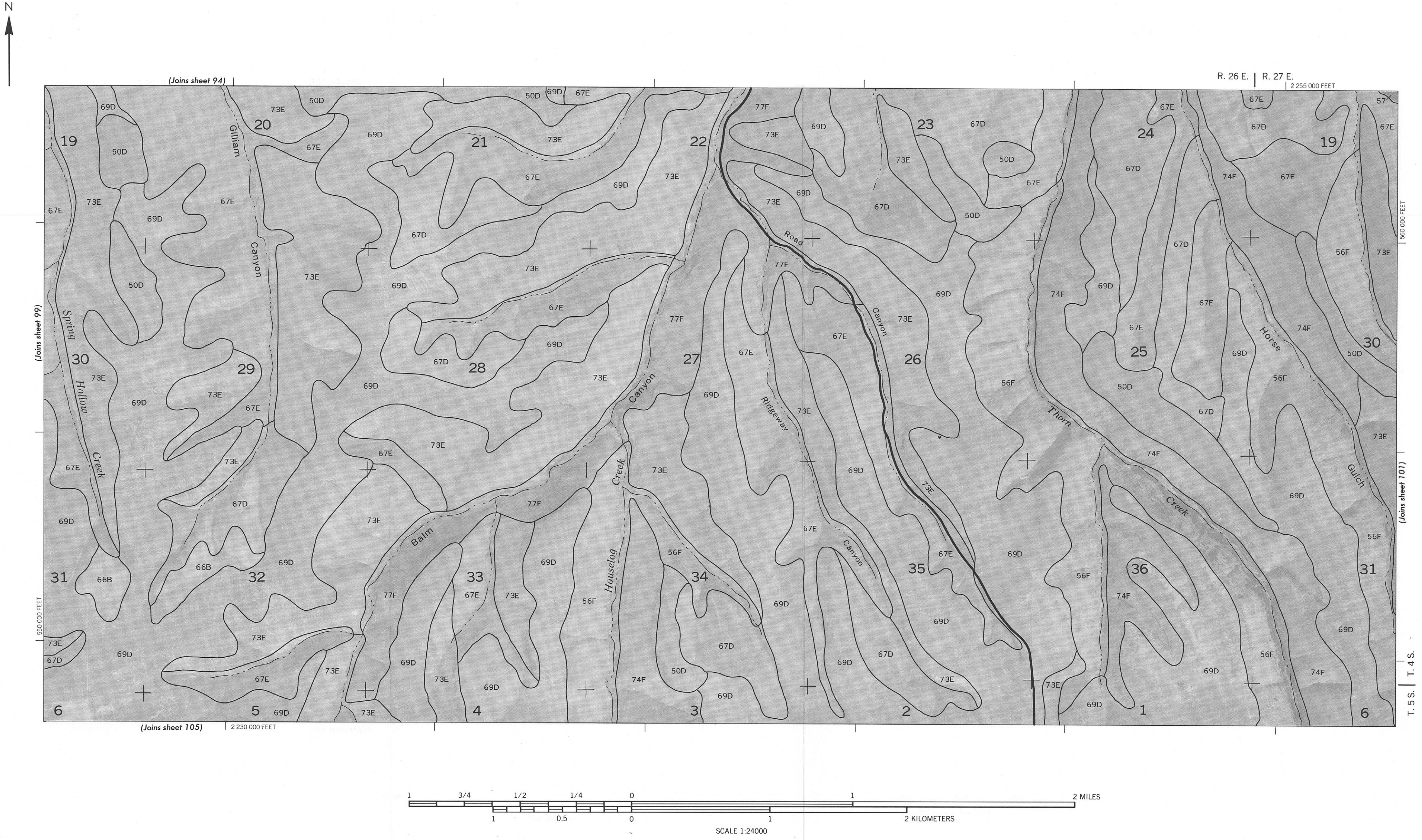
MORROW COUNTY, OREGON NO. 99

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
2 195 000 FEET
(Joins sheet 93)
R. 25 E. | R. 26 E.
560 000 FEET
(Joins sheet 98)
(Joins sheet 100)
550 000 FEET
T. 5 S. | T. 4 S.
(Joins sheet 104)
2 225 000 FEET
19
20
21
22
23
24
19
30
29
28
27
26
25
30
31
32
33
34
35
36
31
6
5
4
3
2
1
6
Spring Canyon
Rood Canyon
McKinney Creek
Campbell Creek
Road Canyon
207
Hardman
31C
3D
31B
32D
32E
28E
57
77F
66B
67E
69D
73E
67D
68D
29F
33D
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

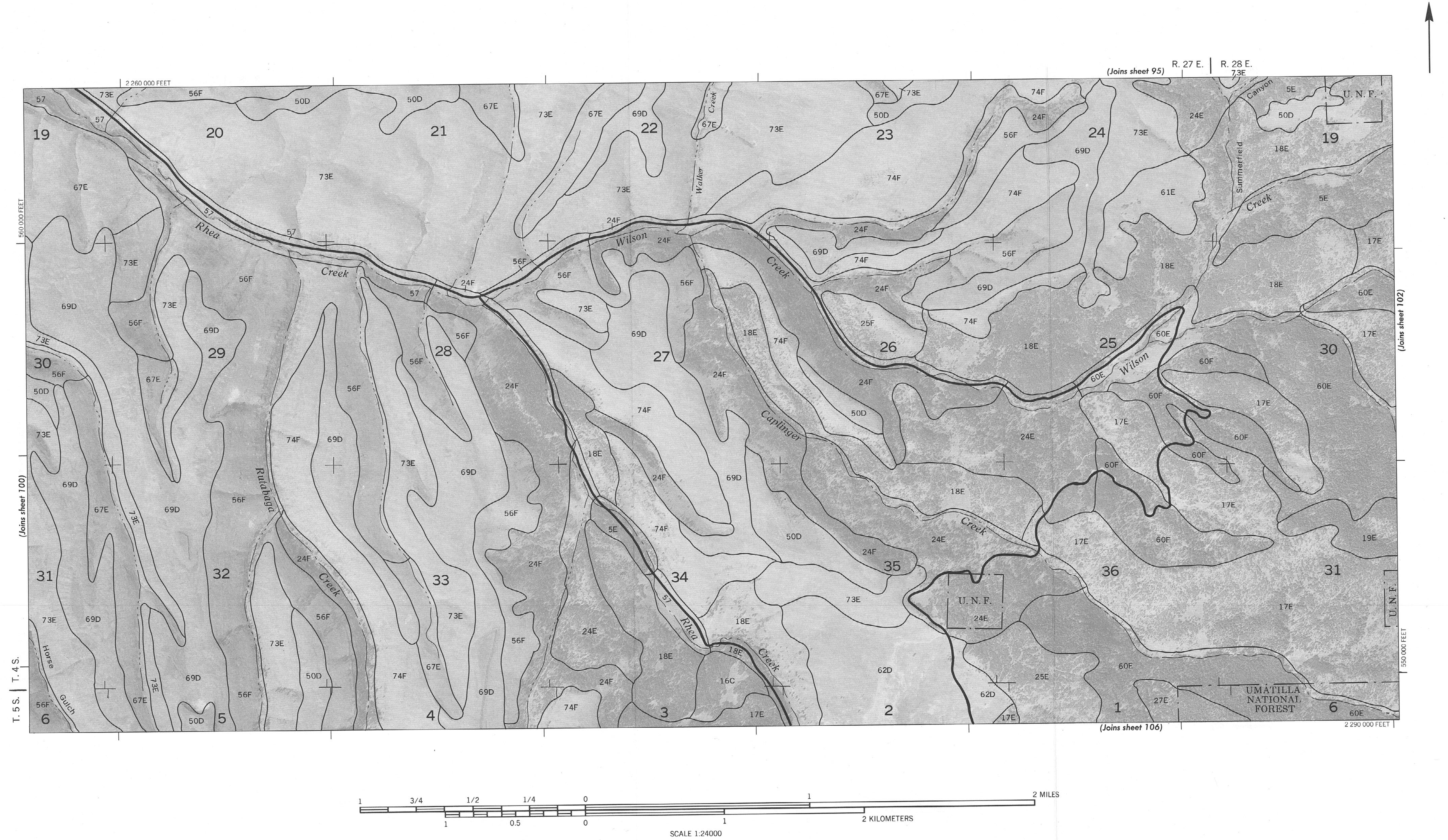
SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 100


N
(Joins sheet 94)
R. 26 E.
R. 27 E.
2 255 000 FEET
(Joins sheet 99)
(Joins sheet 101)
(Joins sheet 105)
2 230 000 FEET
560 000 FEET
550 000 FEET
T. 4 S.
T. 5 S.
19
20
21
22
23
24
19
30
29
28
27
26
25
30
31
32
33
34
35
36
31
6
5
4
3
2
1
6
Spring
Hollow
Creek
Gilliam
Canyon
Balm
Canyon
Creek
Houselog
Creek
Road
Canyon
Ridgeway
Canyon
Thorn
Creek
Horse
Gulch
50D
66B
67D
67E
69D
73E
74F
77F
56F
57
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON — SHEET NUMBER 101


N
(Joins sheet 95)
R. 27 E.
R. 28 E.
2 260 000 FEET
560 000 FEET
(Joins sheet 100)
(Joins sheet 102)
(Joins sheet 106)
550 000 FEET
2 290 000 FEET
T. 4 S.
T. 5 S.
19
20
21
22
23
24
19
30
29
28
27
26
25
30
31
32
33
34
35
36
31
6
5
4
3
2
1
6
Rhea Creek
Wilson Creek
Walker Creek
Caplinger Creek
Rutabaga Creek
Horse Gulch
Summerfield Creek
Canyon
U. N. F.
UMATILLA NATIONAL FOREST
57
73E
56F
50D
67E
69D
74F
24F
24E
18E
17E
60E
60F
61E
5E
25F
25E
27E
16C
62D
19E
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

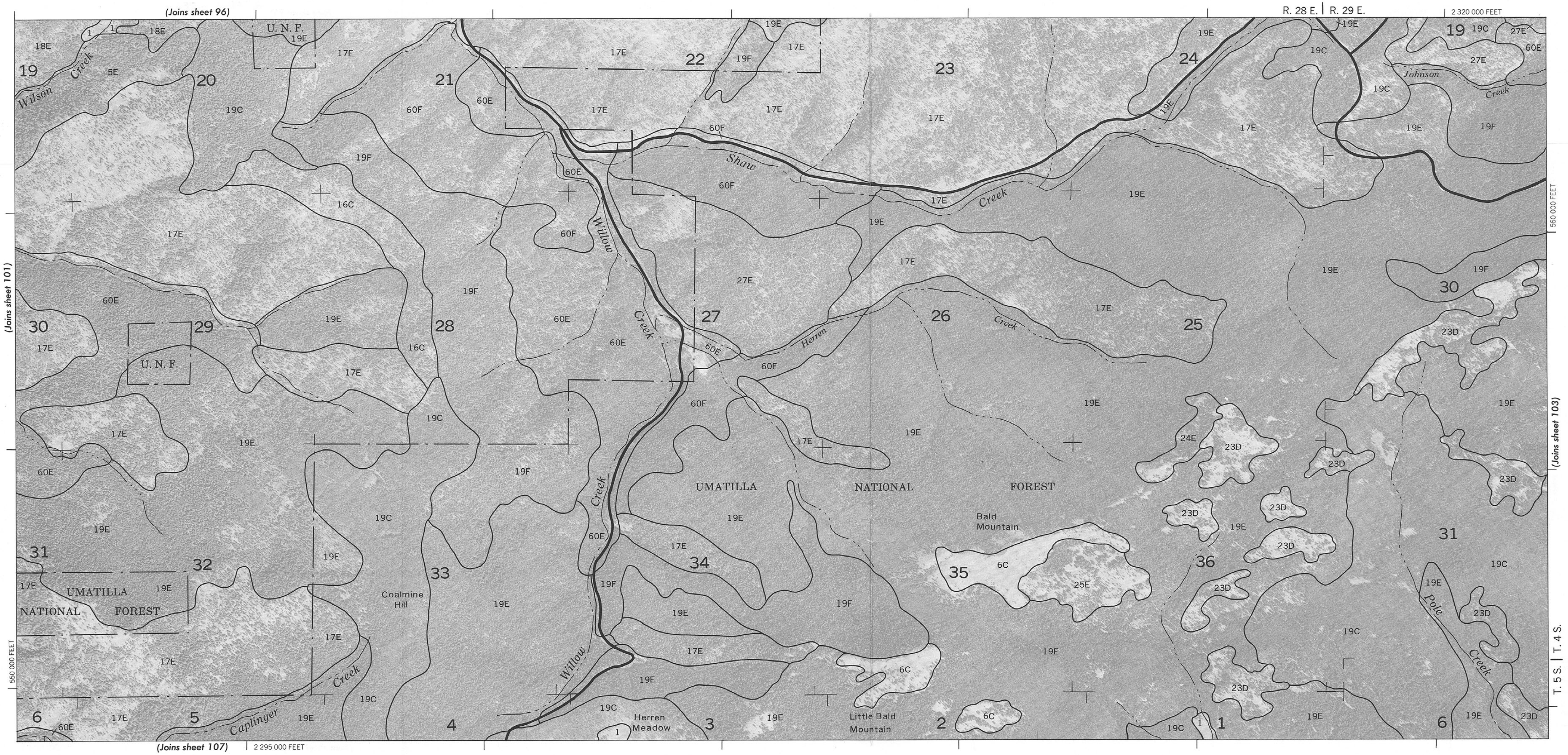
MORROW COUNTY, OREGON NO. 101

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

102

N

MORROW COUNTY, OREGON — SHEET NUMBER 102


(Joins sheet 96)
R. 28 E. | R. 29 E.
2 320 000 FEET
(Joins sheet 101)
(Joins sheet 103)
(Joins sheet 107)
2 295 000 FEET
550 000 FEET
560 000 FEET
T. 4 S.
T. 5 S.
U. N. F.
UMATILLA NATIONAL FOREST
Wilson Creek
Shaw Creek
Willow Creek
Herren Creek
Johnson Creek
Pole Creek
Caplinger Creek
Coalmine Hill
Bald Mountain
Little Bald Mountain
Herren Meadow
19
20
21
22
23
24
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
18E
5E
19C
19E
19F
17E
60E
60F
16C
27E
6C
25E
24E
23D

1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 102

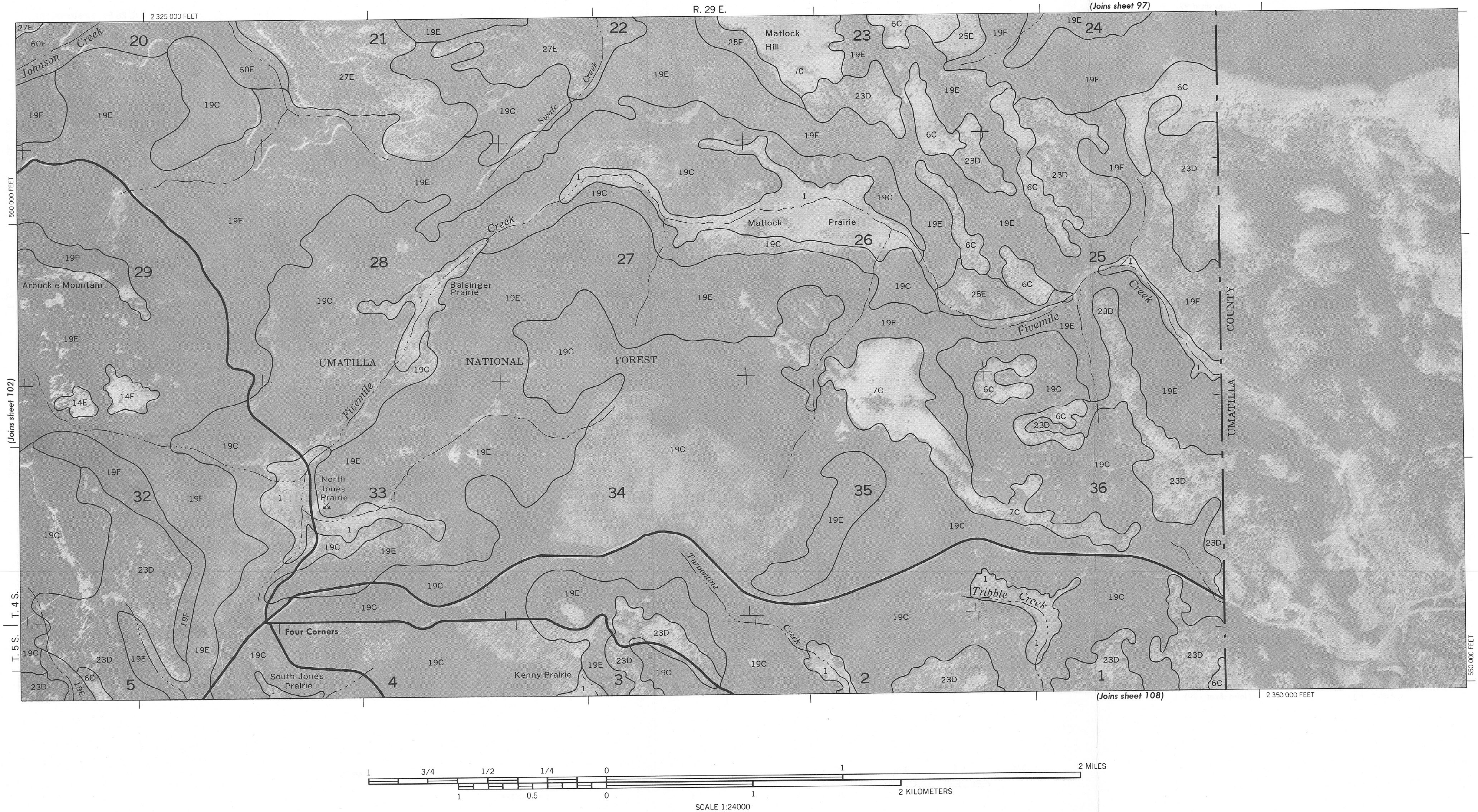
103

N

MORROW COUNTY, OREGON — SHEET NUMBER 103

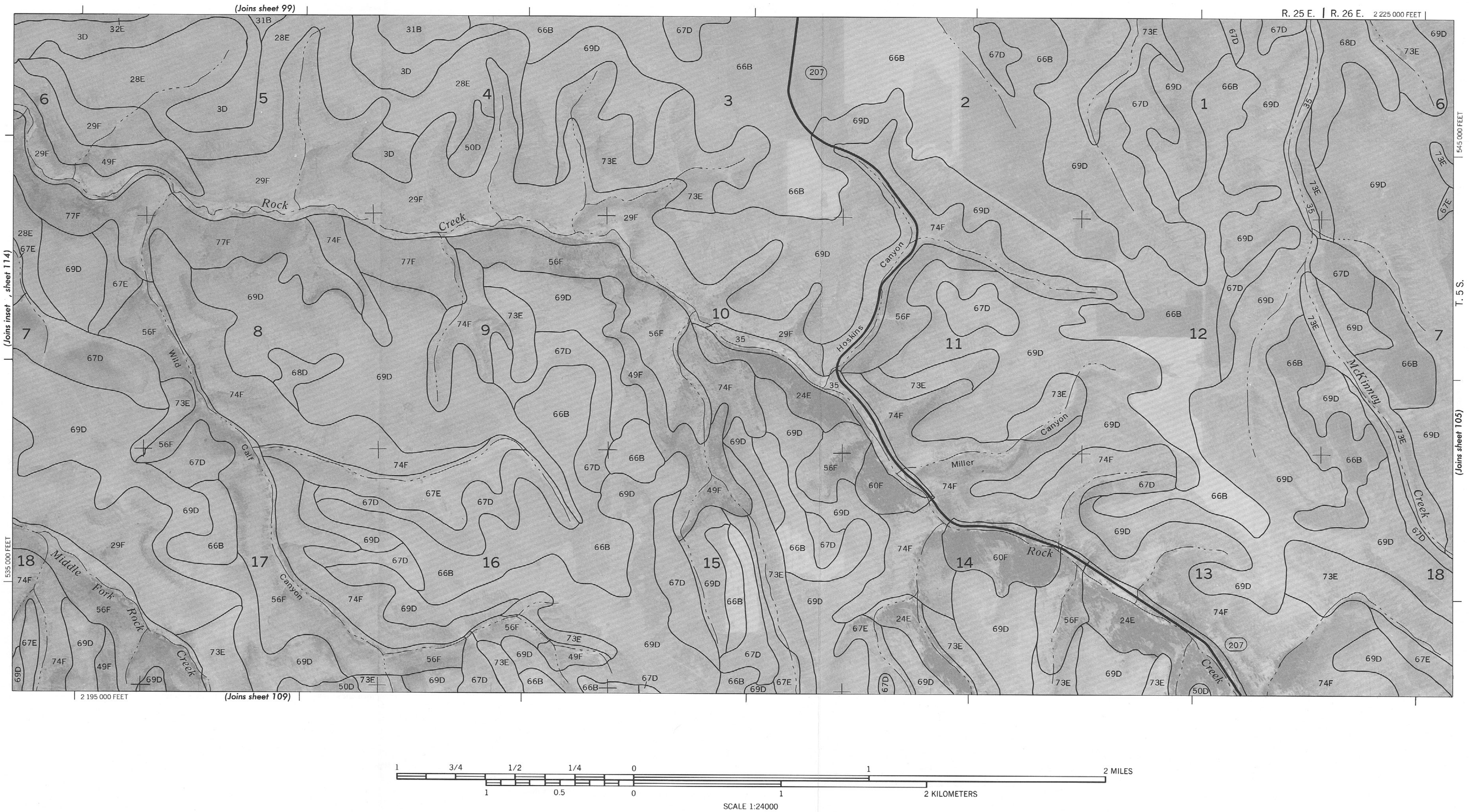
MORROW COUNTY, OREGON NO. 103

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


2 325 000 FEET
R. 29 E.
(Joins sheet 97)
(Joins sheet 102)
(Joins sheet 108)
560 000 FEET
550 000 FEET
2 350 000 FEET
T. 4 S.
T. 5 S.
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
1
2
3
4
5
Johnson Creek
Swale Creek
Fivemile Creek
Turpentine Creek
Tribble Creek
Matlock Hill
Matlock Prairie
Balsinger Prairie
Arbuckle Mountain
North Jones Prairie
South Jones Prairie
Kenny Prairie
Four Corners
UMATILLA NATIONAL FOREST
UMATILLA COUNTY
27E
60E
19F
19E
19C
1
6C
7C
14E
23D
25E
25F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

N

MORROW COUNTY, OREGON — SHEET NUMBER 104


(Joins sheet 99)
R. 25 E. | R. 26 E.
2 225 000 FEET
545 000 FEET
T. 5 S.
(Joins sheet 105)
(Joins inset , sheet 114)
535 000 FEET
2 195 000 FEET
(Joins sheet 109)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Rock Creek
Hoskins Canyon
Miller Canyon
McKinney Creek
Wild Calf Canyon
Middle Fork Rock Creek
207
35
3D
32E
31B
28E
29F
49F
77F
67E
69D
67D
56F
74F
73E
68D
50D
66B
60F
24E
67E
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

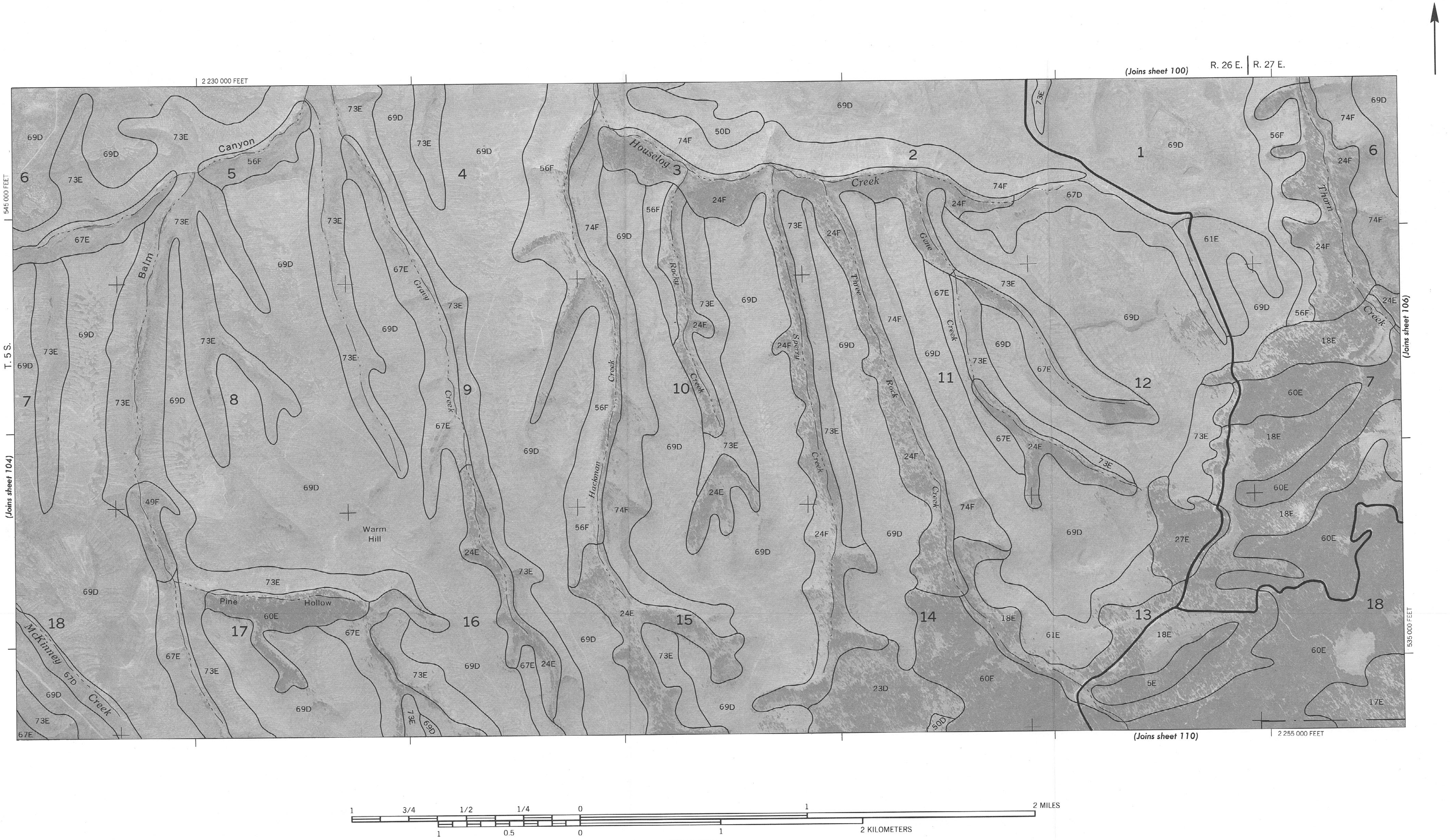
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 104

MORROW COUNTY, OREGON — SHEET NUMBER 105

MORROW COUNTY, OREGON NO. 105

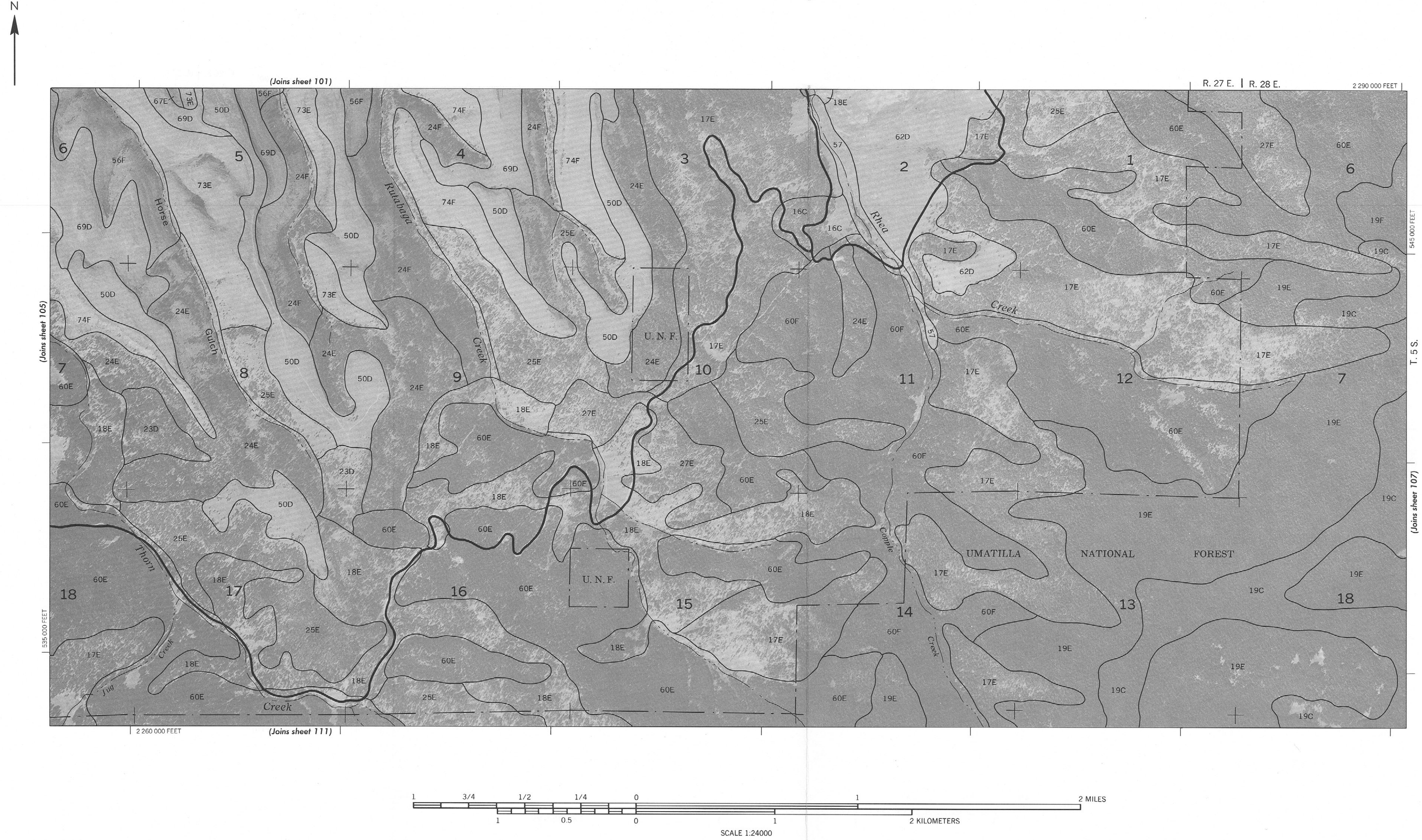
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
(Joins sheet 100)
R. 26 E.
R. 27 E.
2 230 000 FEET
545 000 FEET
T. 5 S.
(Joins sheet 104)
(Joins sheet 106)
(Joins sheet 110)
535 000 FEET
2 255 000 FEET
Canyon
Balm
Grany
Creek
Houselog
Creek
Rocky
Creek
Hackman
Creek
Sperry
Creek
Three
Rock
Creek
Gone
Creek
Thorn
Creek
McKinney
Creek
Warm
Hill
Pine
Hollow
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
69D
73E
67E
56F
74F
50D
24F
67D
61E
24E
18E
60E
49F
27E
23D
5E
17E
67D
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

(106)

MORROW COUNTY, OREGON — SHEET NUMBER 106


N
(Joins sheet 101)
(Joins sheet 105)
(Joins sheet 107)
(Joins sheet 111)
R. 27 E.
R. 28 E.
T. 5 S.
2 290 000 FEET
2 260 000 FEET
545 000 FEET
535 000 FEET
Horse
Gulch
Rutabaga
Creek
Rhea
Creek
Thorn
Creek
Jug
Creek
Copple
Creek
U. N. F.
U. N. F.
UMATILLA NATIONAL FOREST
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
6
7
18
67E
73E
69D
50D
56F
73E
56F
74F
24F
24F
74F
17E
18E
62D
57
17E
25E
60E
27E
60E
56F
73E
69D
24F
69D
74F
50D
24E
50D
16C
16C
17E
19F
19C
69D
50D
24F
73E
24F
25E
17E
62D
17E
60E
19E
50D
74F
24E
24E
24E
60F
24E
60F
57
60E
19C
60E
50D
50D
24E
50D
25E
50D
U. N. F.
24E
17E
17E
17E
19E
25E
18E
27E
25E
60E
23D
24E
18E
60E
18E
27E
60E
60F
17E
60E
23D
18E
60E
60E
18E
19E
19C
60E
50D
25E
60E
60E
18E
18E
60E
17E
19F
60E
18E
18E
60E
19C
25E
60F
60F
17E
19E
19E
19E
19C
17E
18E
60E
18E
25E
18E
60E
60E
19E
19C
Creek
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

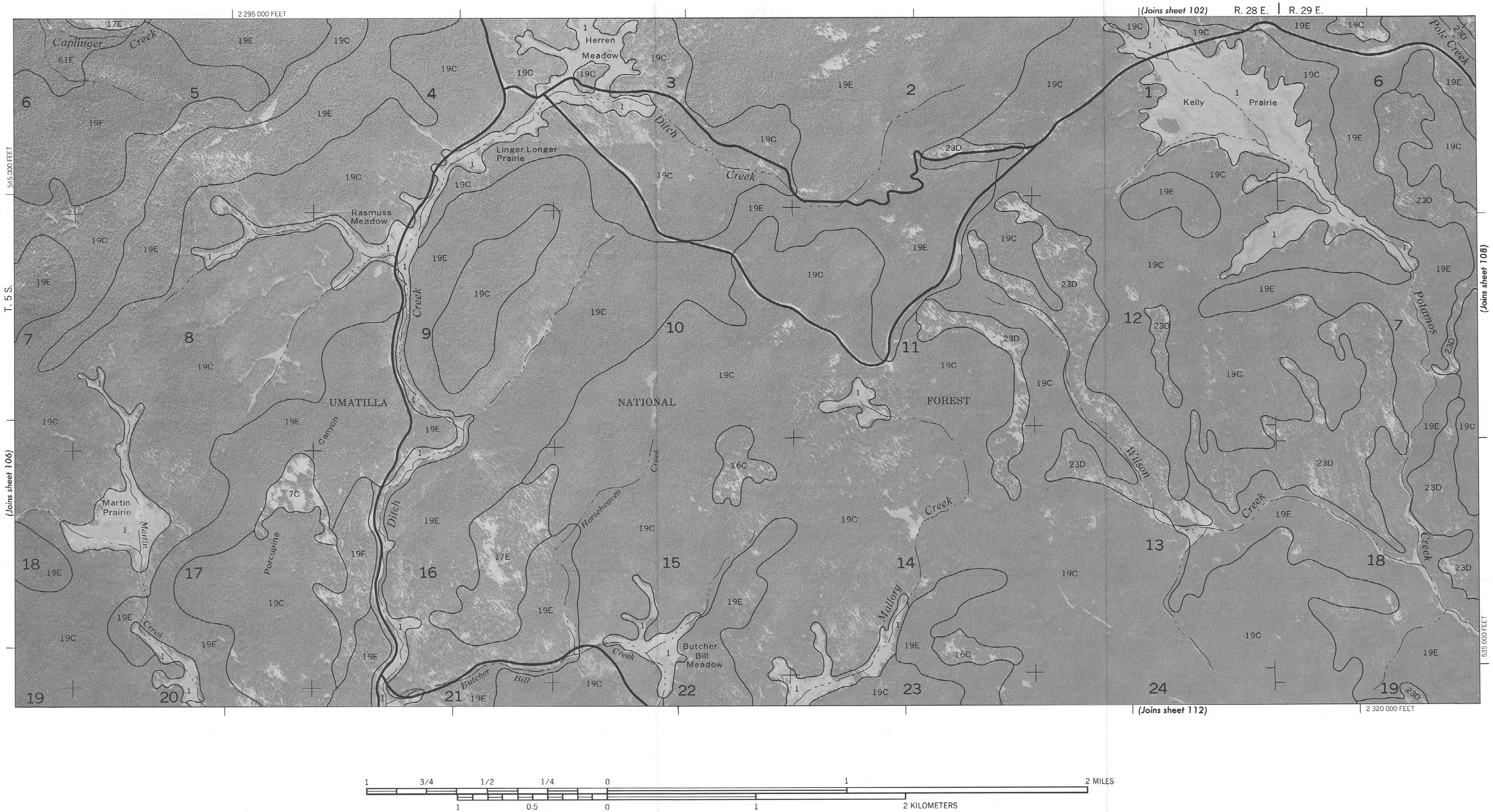
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 106

MORROW COUNTY, OREGON — SHEET NUMBER 107



N
(Joins sheet 102)
R. 28 E.
R. 29 E.
2 295 000 FEET
545 000 FEET
T. 5 S.
(Joins sheet 106)
(Joins sheet 108)
(Joins sheet 112)
535 000 FEET
2 320 000 FEET
Caplinger Creek
Herren Meadow
Linger Longer Prairie
Rasmuss Meadow
Ditch Creek
Kelly Prairie
Pole Creek
Potamos Creek
Wilson Creek
Martin Prairie
Martin Creek
Canyon Creek
Porcupine
Horseheaven Creek
Mallory Creek
Butcher Bill Meadow
Butcher Bill Creek
UMATILLA NATIONAL FOREST
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
1
7C
16C
17E
19C
19E
19F
23D
61E
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

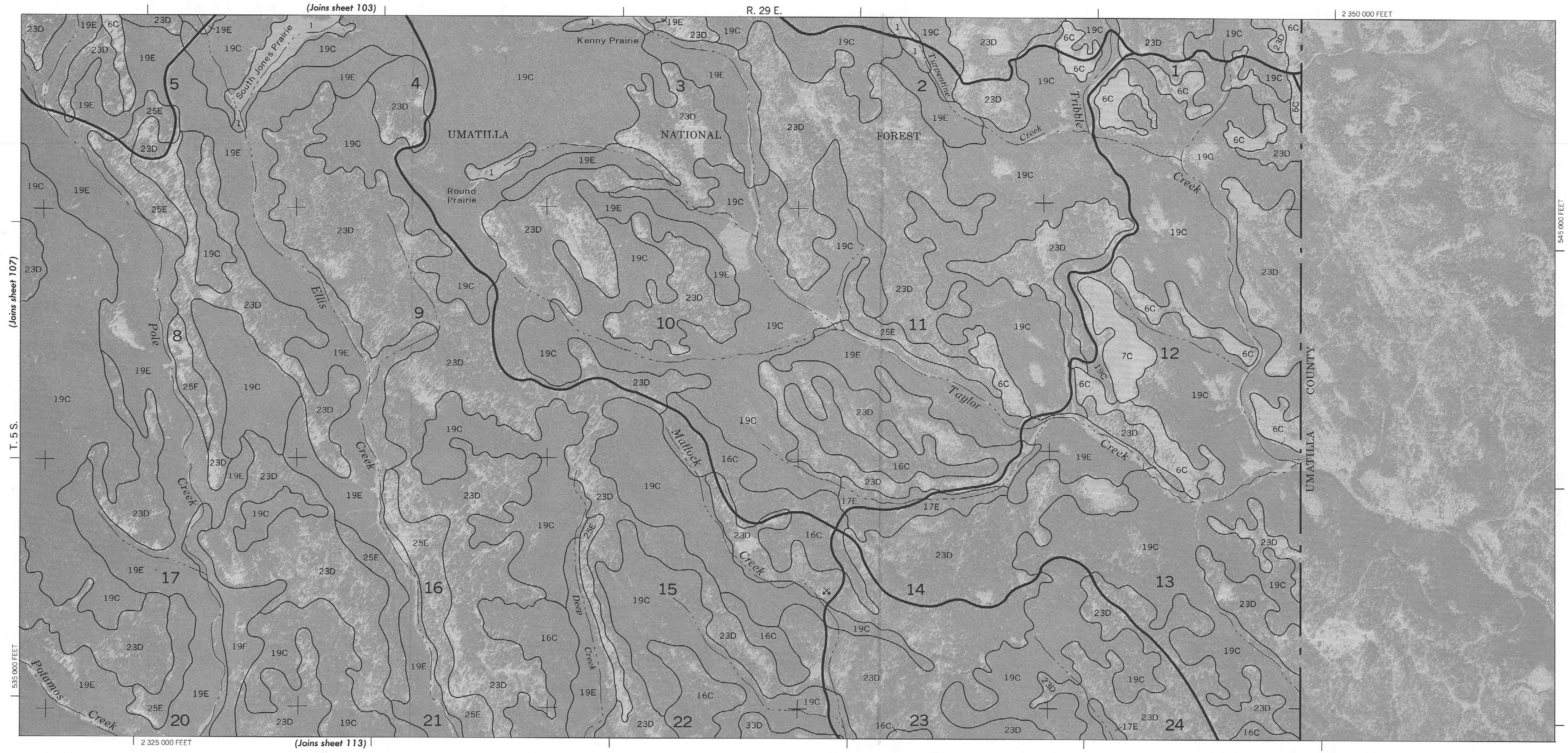
MORROW COUNTY, OREGON NO. 107

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

108

N

MORROW COUNTY, OREGON — SHEET NUMBER 108


(Joins sheet 103)
R. 29 E.
2 350 000 FEET
(Joins sheet 107)
T. 5 S.
545 000 FEET
535 000 FEET
2 325 000 FEET
(Joins sheet 113)
Kenny Prairie
South Jones Prairie
UMATILLA
NATIONAL
FOREST
Round Prairie
Turpentine
Tribble
Creek
Ellis
Pole
Creek
Creek
Taylor
Creek
Matlock
Creek
Deep
Creek
Potamos
Creek
UMATILLA
COUNTY
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
20
21
22
23
24
19C
19E
23D
6C
7C
16C
17E
25E
25F
19F
33D
1

1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

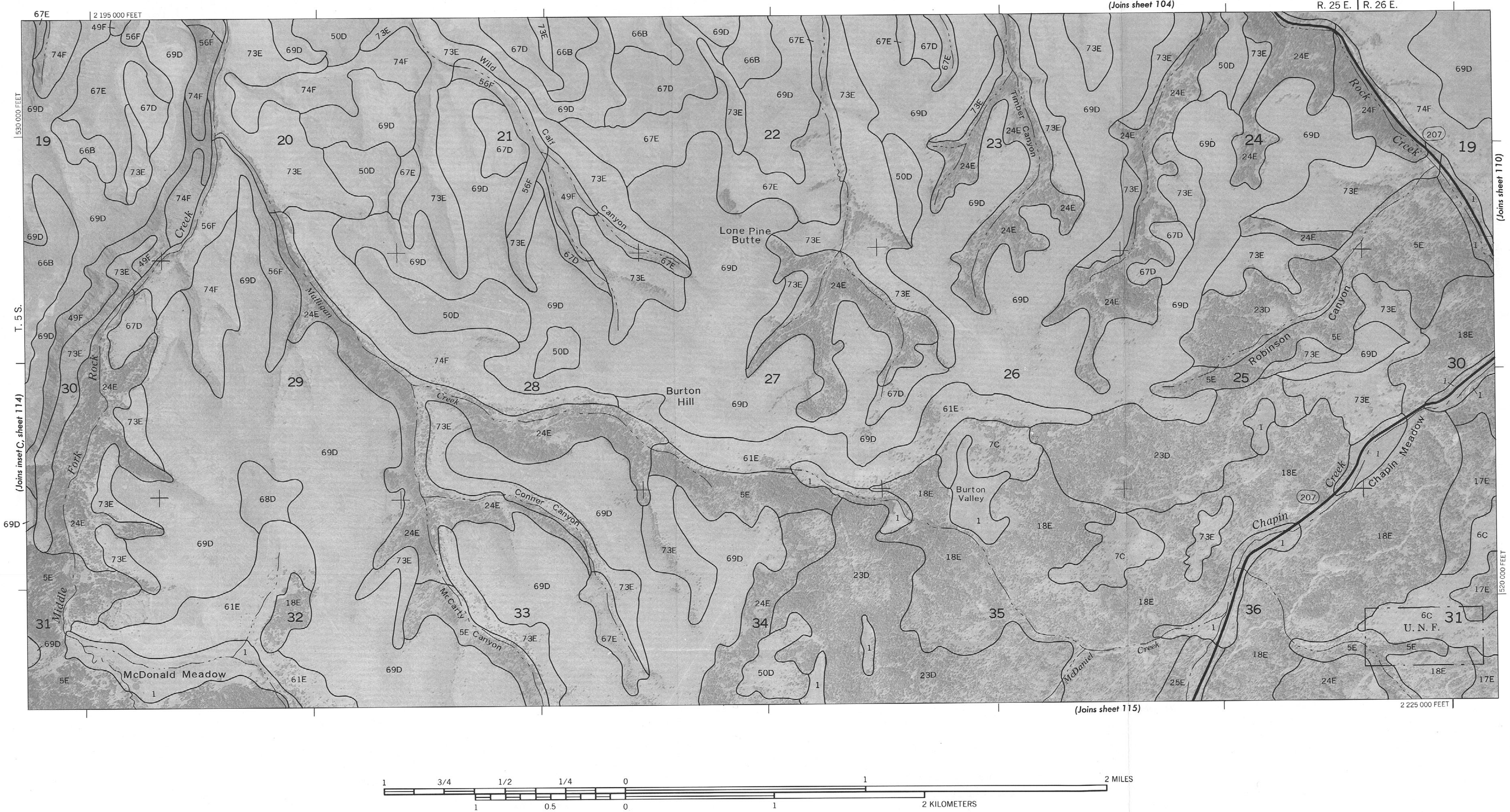
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 108

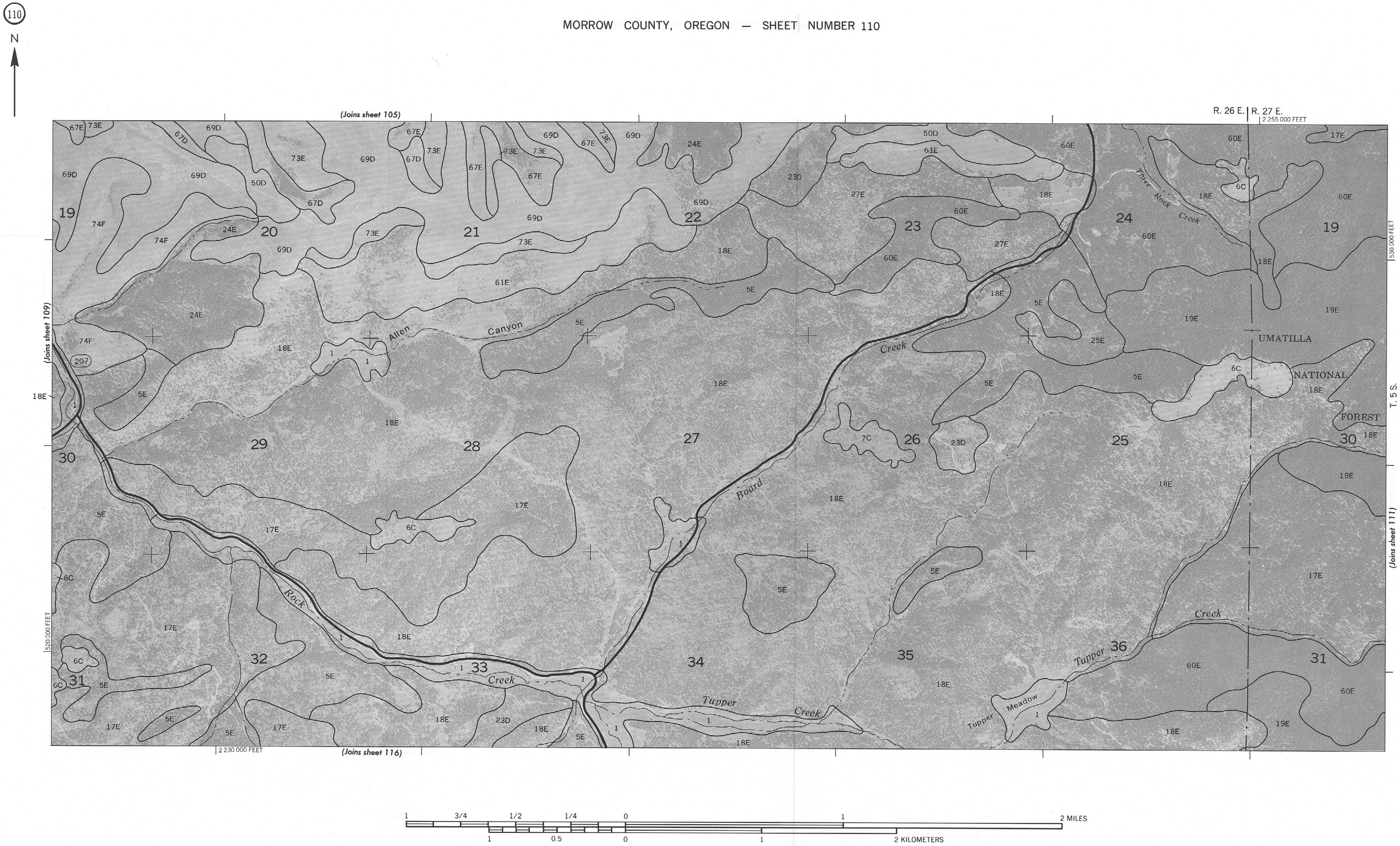
MORROW COUNTY, OREGON — SHEET NUMBER 109

MORROW COUNTY, OREGON NO. 109

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


(Joins sheet 104)
R. 25 E.
R. 26 E.
2 195 000 FEET
530 000 FEET
T. 5 S.
(Joins inset C, sheet 114)
(Joins sheet 110)
520 000 FEET
(Joins sheet 115)
2 225 000 FEET
Wild Calf Canyon
Lone Pine Butte
Timber Canyon
Rock Creek
Robinson Canyon
Mulligan Creek
Burton Hill
Middle Fork Rock Creek
Conner Canyon
McCarty Canyon
Burton Valley
Chapin Creek
Chapin Meadow
McDonald Meadow
McDaniel Creek
U. N. F.
207
19
20
21
22
23
24
19
30
29
28
27
26
25
30
31
32
33
34
35
36
31
67E
49F
56F
74F
69D
73E
50D
67D
66B
67E
24E
74F
69D
73E
61E
68D
5E
18E
23D
7C
6C
17E
1
25E
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 110


N
(Joins sheet 105)
(Joins sheet 109)
(Joins sheet 111)
(Joins sheet 116)
R. 26 E.
R. 27 E.
T. 5 S.
2 255 000 FEET
530 000 FEET
520 000 FEET
2 230 000 FEET
UMATILLA
NATIONAL
FOREST
Allen Canyon
Three Rock Creek
Board Creek
Rock Creek
Tupper Creek
Tupper Meadow
207
19
20
21
22
23
24
19
30
29
28
27
26
25
30
31
32
33
34
35
36
31
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

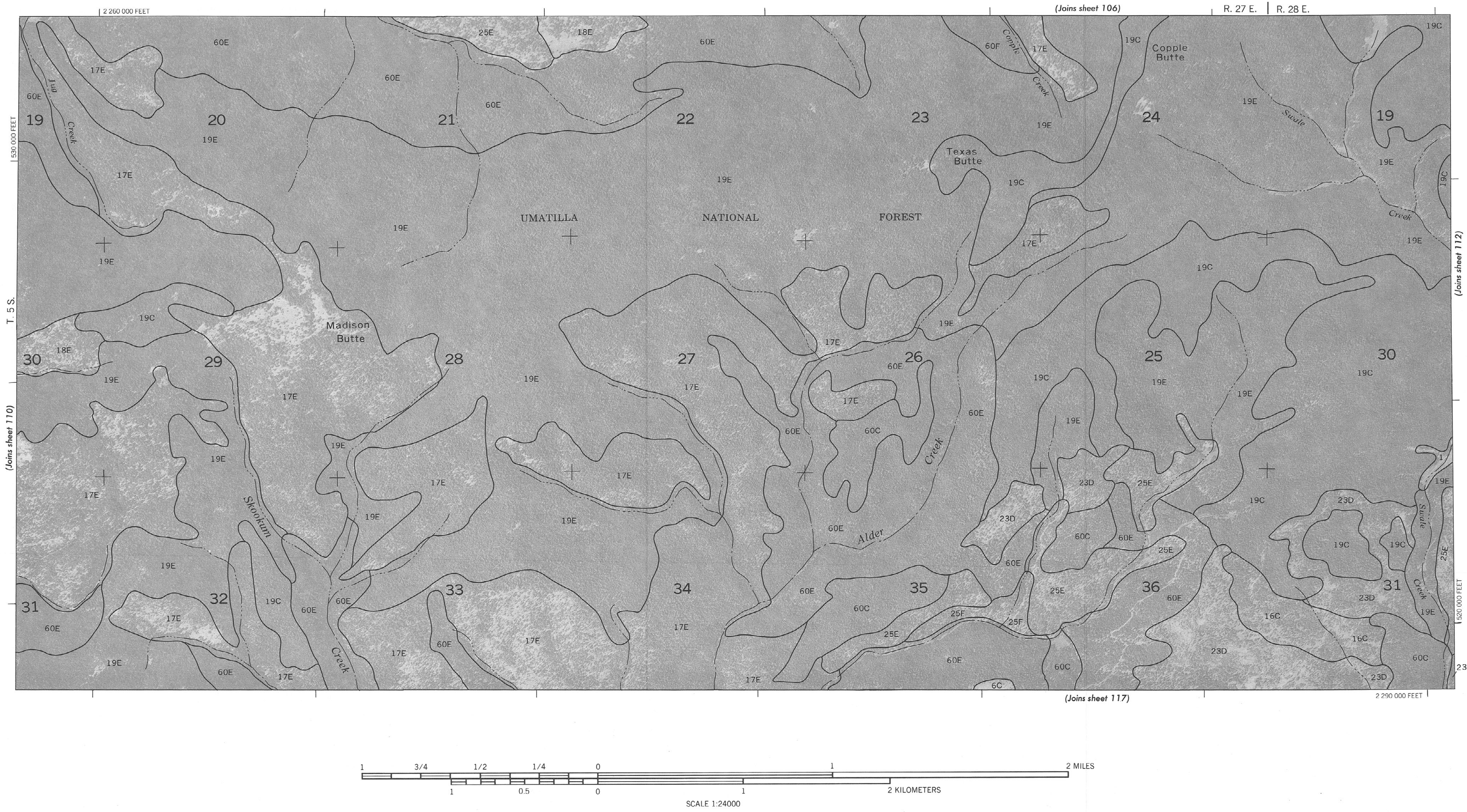
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON — SHEET NUMBER 111


2 260 000 FEET
(Joins sheet 106)
R. 27 E.
R. 28 E.
530 000 FEET
T. 5 S.
(Joins sheet 110)
(Joins sheet 112)
(Joins sheet 117)
520 000 FEET
2 290 000 FEET
UMATILLA
NATIONAL
FOREST
Madison Butte
Texas Butte
Copple Butte
Jug Creek
Skookum Creek
Alder Creek
Copple Creek
Swale Creek
19
20
21
22
23
24
19
30
29
28
27
26
25
30
31
32
33
34
35
36
31
60E
17E
25E
18E
60E
60E
60F
17E
19C
19E
19E
19E
19E
19E
19C
19C
19C
17E
18E
19E
17E
17E
17E
60E
17E
60E
60C
60E
19E
19C
19E
23D
25E
23D
60C
60E
25E
25E
36
23D
16C
16C
23D
23D
60C
25F
25F
25E
6C
60E
60C
17E
17E
17E
60E
17E
60E
19E
19C
60E
60E
17E
19E
19E
1
25E
23D
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

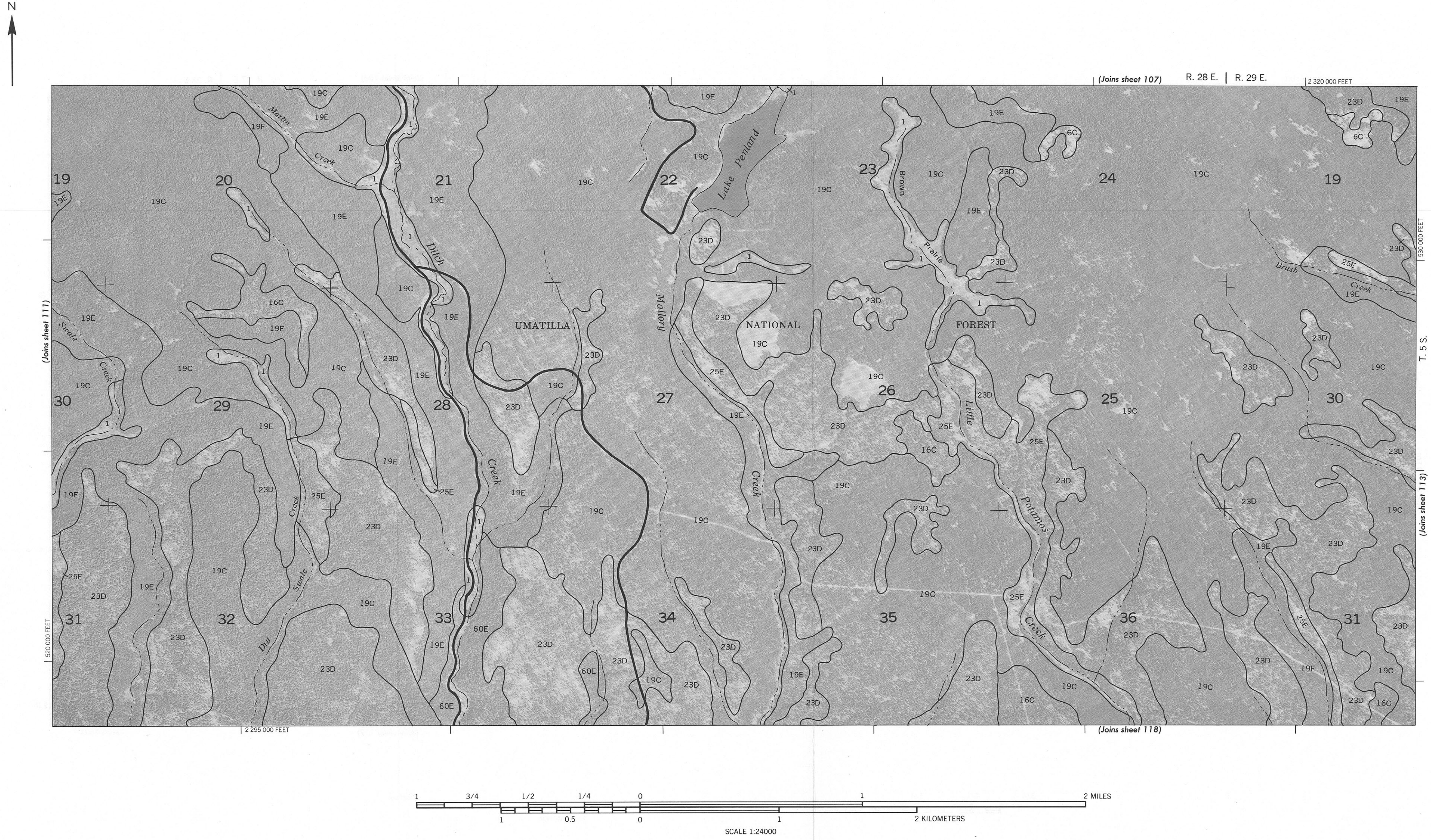
MORROW COUNTY, OREGON NO. 111

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MORROW COUNTY, OREGON — SHEET NUMBER 112


N
(Joins sheet 107)
R. 28 E.
R. 29 E.
2 320 000 FEET
530 000 FEET
520 000 FEET
2 295 000 FEET
(Joins sheet 111)
(Joins sheet 113)
(Joins sheet 118)
T. 5 S.
19
20
21
22
23
24
19
30
29
28
27
26
25
30
31
32
33
34
35
36
31
UMATILLA
NATIONAL
FOREST
Lake Penland
Martin Creek
Ditch Creek
Mallory Creek
Brown Prairie
Little Potamus Creek
Brush Creek
Swale Creek
Dry Swale Creek
Creek
1
6C
16C
19C
19E
19F
23D
25E
60E
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

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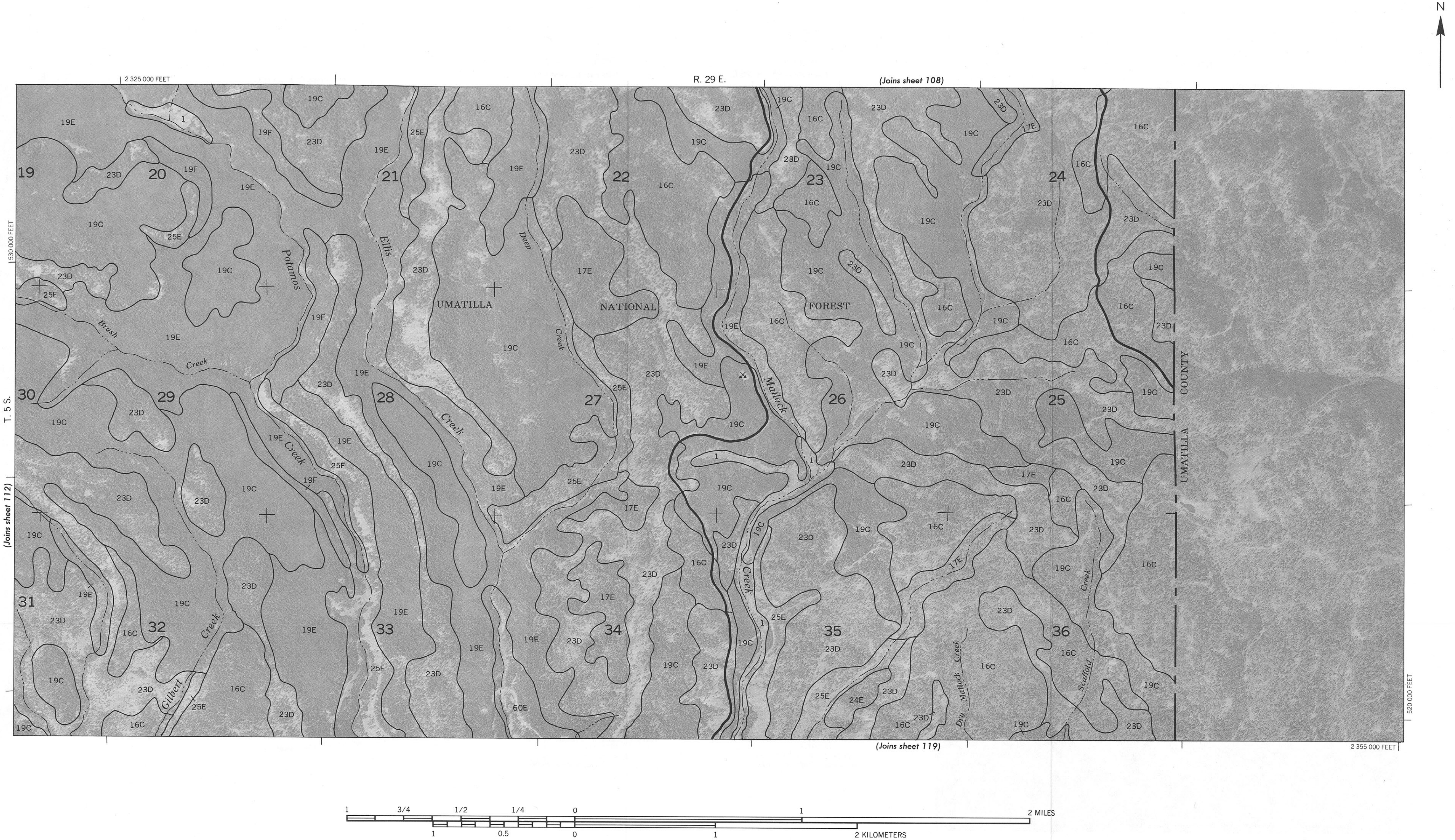
MORROW COUNTY, OREGON NO. 112

MORROW COUNTY, OREGON — SHEET NUMBER 113

MORROW COUNTY, OREGON NO. 113

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

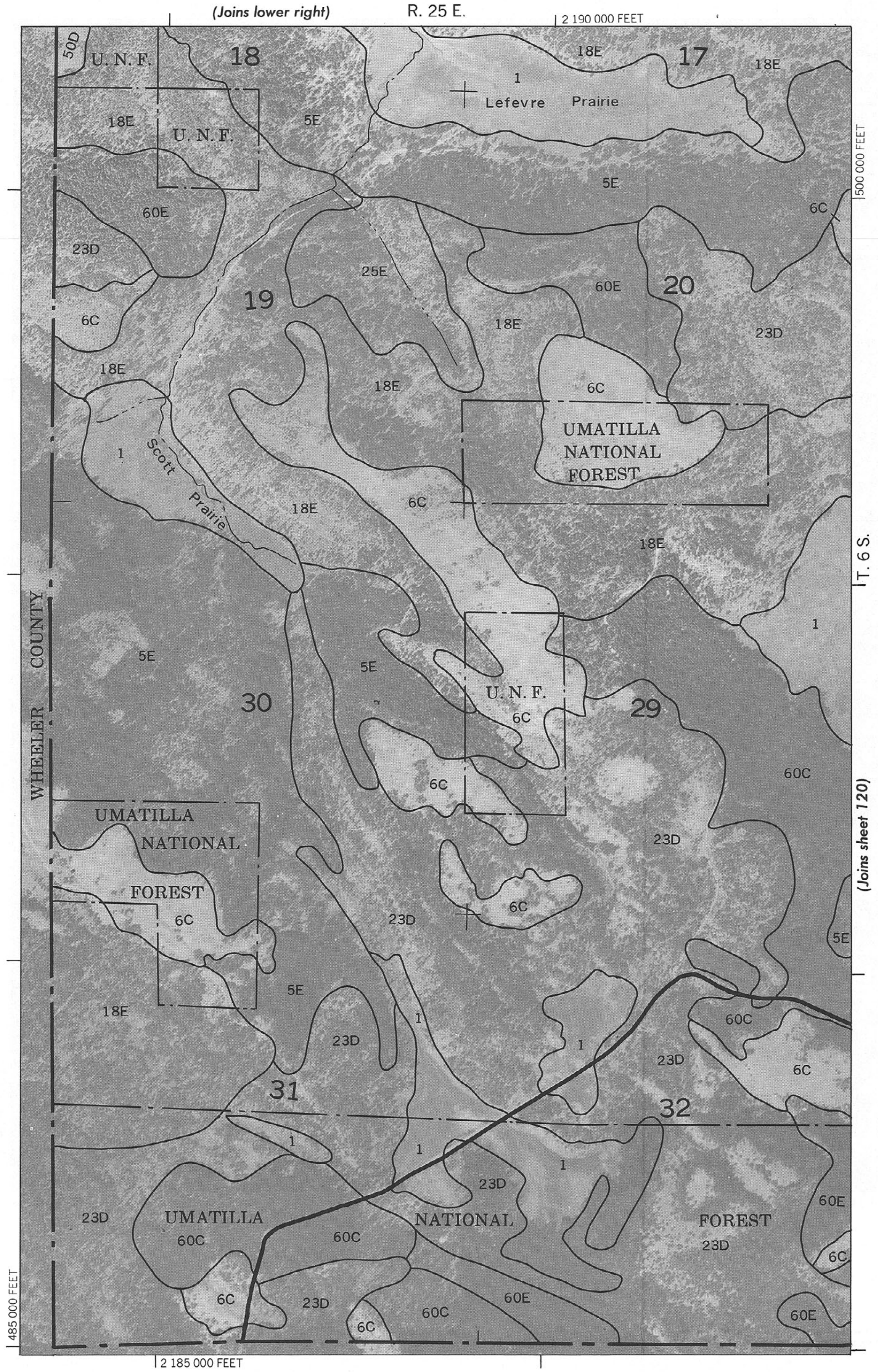

N
2 325 000 FEET
R. 29 E.
(Joins sheet 108)
530 000 FEET
T. 5 S.
(Joins sheet 112)
(Joins sheet 119)
2 355 000 FEET
520 000 FEET
19
20
21
22
23
24
30
29
28
27
26
25
31
32
33
34
35
36
UMATILLA
NATIONAL
FOREST
UMATILLA
COUNTY
Potamos
Ellis
Deep
Creek
Brush
Creek
Creek
Creek
Mallock
Creek
Gilbert
Creek
Dry
Mallock
Creek
Scaffold
Creek
1
16C
17E
19C
19E
19F
23D
24E
25E
25F
60E
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SCALE 1:24000

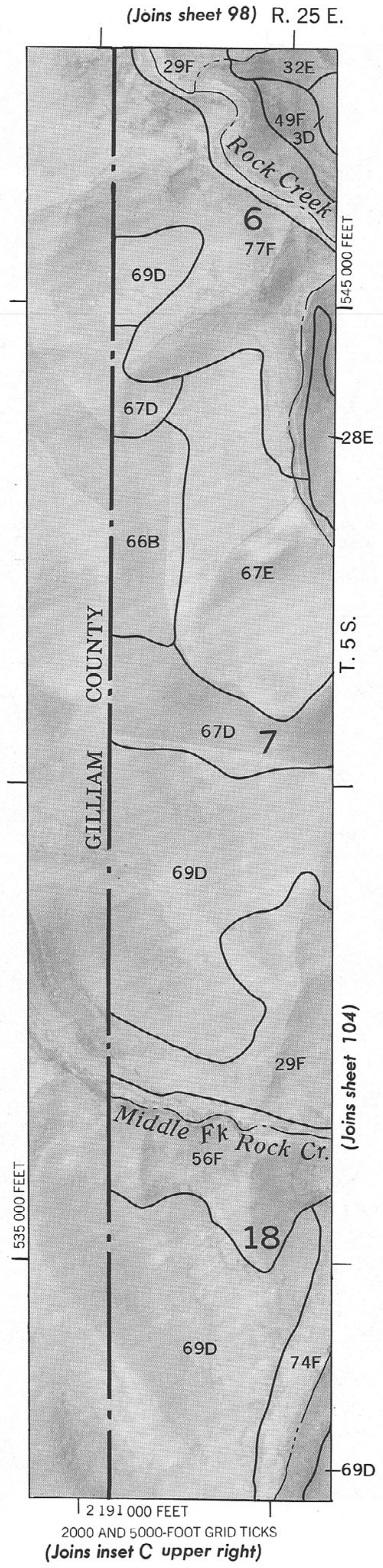
N

MORROW COUNTY, OREGON — SHEET NUMBER 114

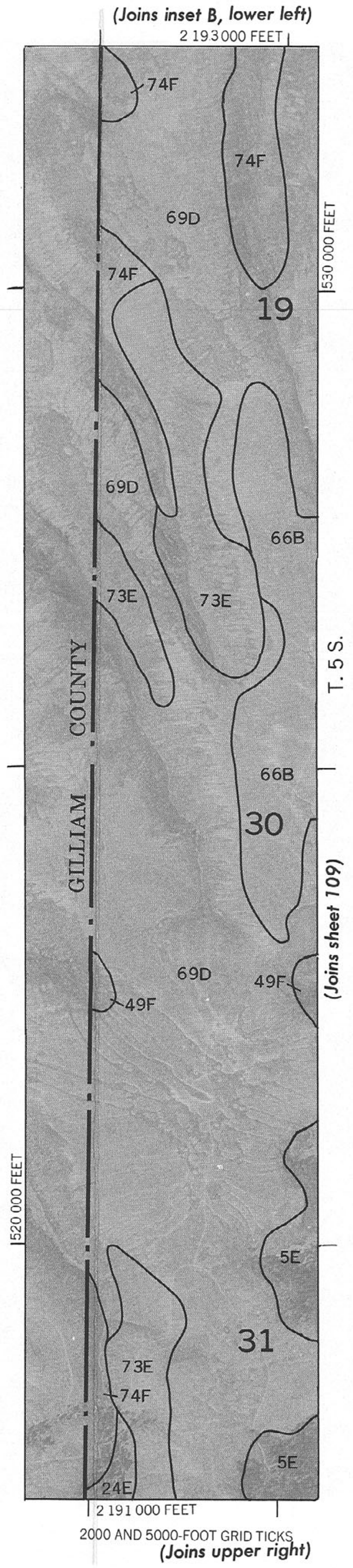
INSET A

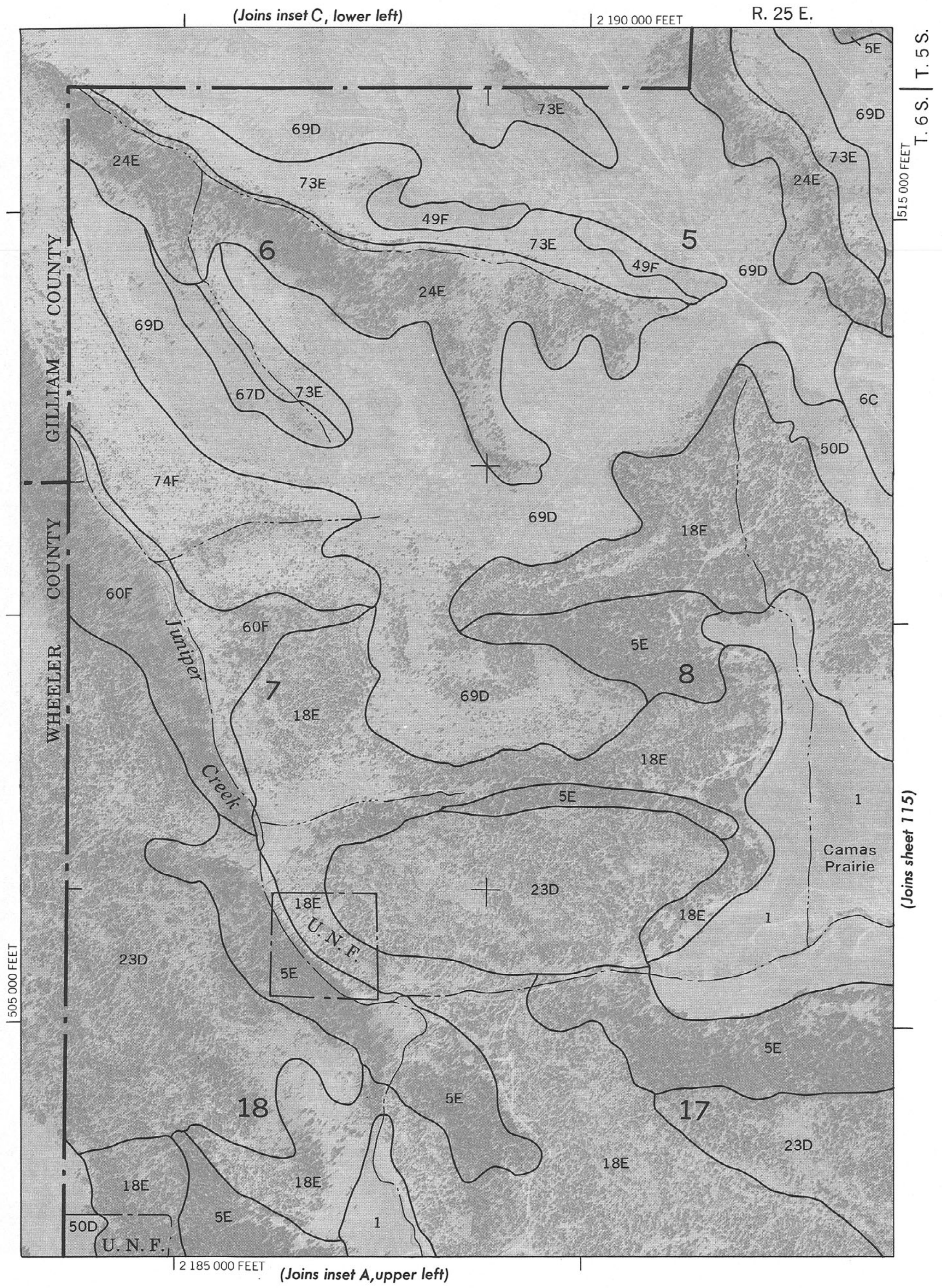

(Joins lower right)
R. 25 E.
2 190 000 FEET
500 000 FEET
485 000 FEET
2 185 000 FEET
T. 6 S.
(Joins sheet 120)
WHEELER COUNTY
50D
U. N. F.
18
18E
U. N. F.
5E
1
Lefevre Prairie
18E
17
18E
5E
6C
60E
23D
6C
19
25E
60E
20
23D
18E
18E
18E
6C
UMATILLA NATIONAL FOREST
1
Scott Prairie
18E
6C
18E
1
5E
30
5E
U. N. F.
6C
29
60C
6C
23D
6C
UMATILLA NATIONAL FOREST
6C
23D
5E
18E
5E
23D
1
1
60C
23D
6C
31
32
1
1
23D
1
UMATILLA
NATIONAL
FOREST
23D
60C
60C
6C
23D
6C
60C
60E
60E
6C
60E

INSET B


(Joins sheet 98)
R. 25 E.
29F
32E
49F
3D
Rock Creek
6
77F
69D
545 000 FEET
28E
67D
66B
67E
GILLIAM COUNTY
T. 5 S.
67D
7
69D
29F
Middle Fk Rock Cr.
56F
18
535 000 FEET
69D
74F
69D
(Joins sheet 104)
2 191 000 FEET
2000 AND 5000-FOOT GRID TICKS
(Joins inset C upper right)

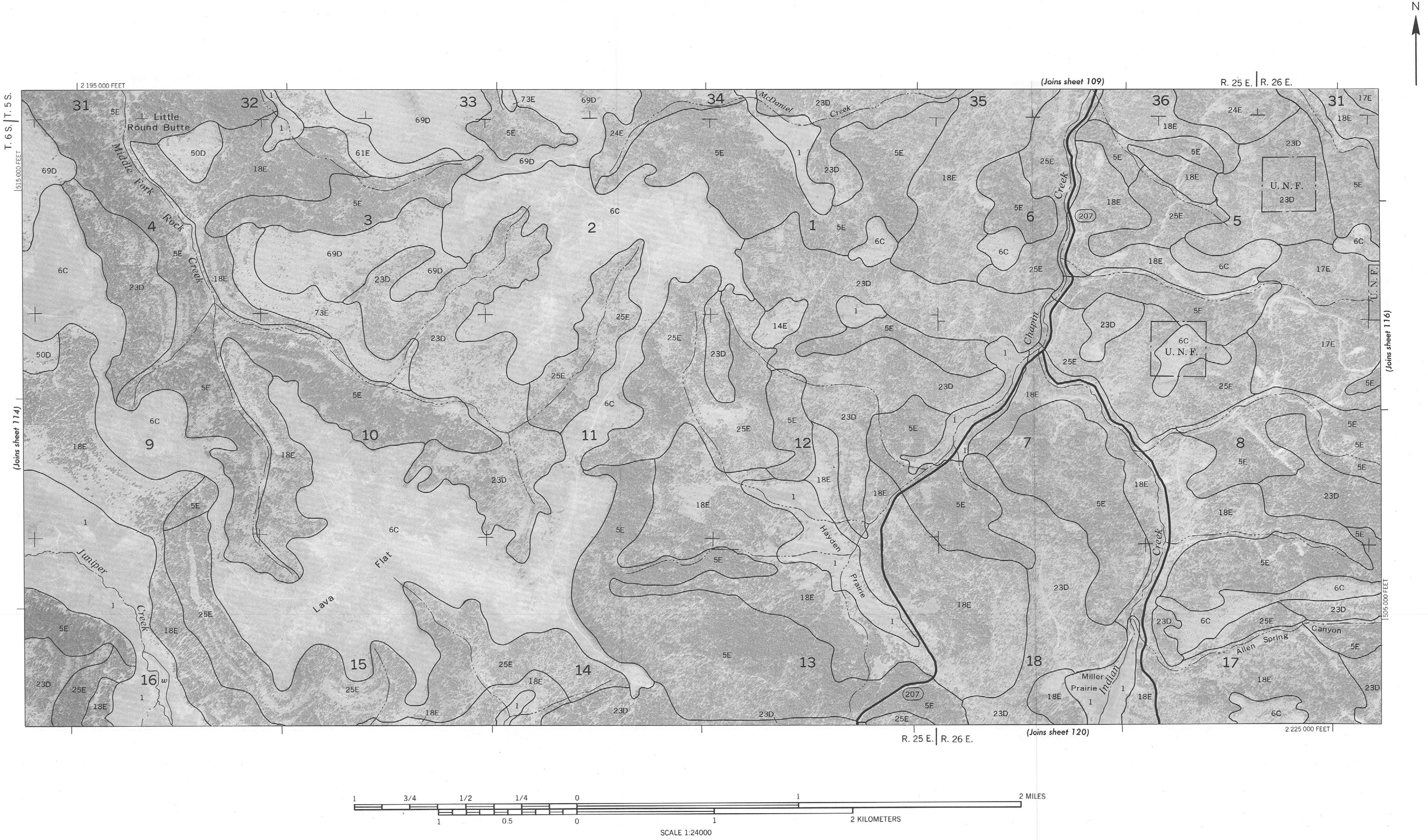
INSET C R. 25 E.


(Joins inset B, lower left)
2 193 000 FEET
74F
74F
69D
530 000 FEET
74F
19
69D
66B
73E
73E
GILLIAM COUNTY
T. 5 S.
66B
30
69D
49F
49F
(Joins sheet 109)
520 000 FEET
5E
73E
74F
31
24E
5E
2 191 000 FEET
2000 AND 5000-FOOT GRID TICKS
(Joins upper right)


(Joins inset C, lower left)
2 190 000 FEET
R. 25 E.
5E
T. 5 S.
T. 6 S.
69D
515 000 FEET
73E
69D
73E
24E
24E
73E
49F
5
6
73E
49F
69D
24E
GILLIAM COUNTY
69D
67D
73E
6C
50D
74F
69D
18E
60F
60F
5E
8
WHEELER COUNTY
Juniper Creek
7
18E
69D
18E
1
5E
Camas Prairie
(Joins sheet 115)
18E
23D
U. N. F.
18E
1
505 000 FEET
23D
5E
5E
5E
18
17
23D
18E
18E
18E
5E
50D
U. N. F.
1
2 185 000 FEET
(Joins inset A, upper left)

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

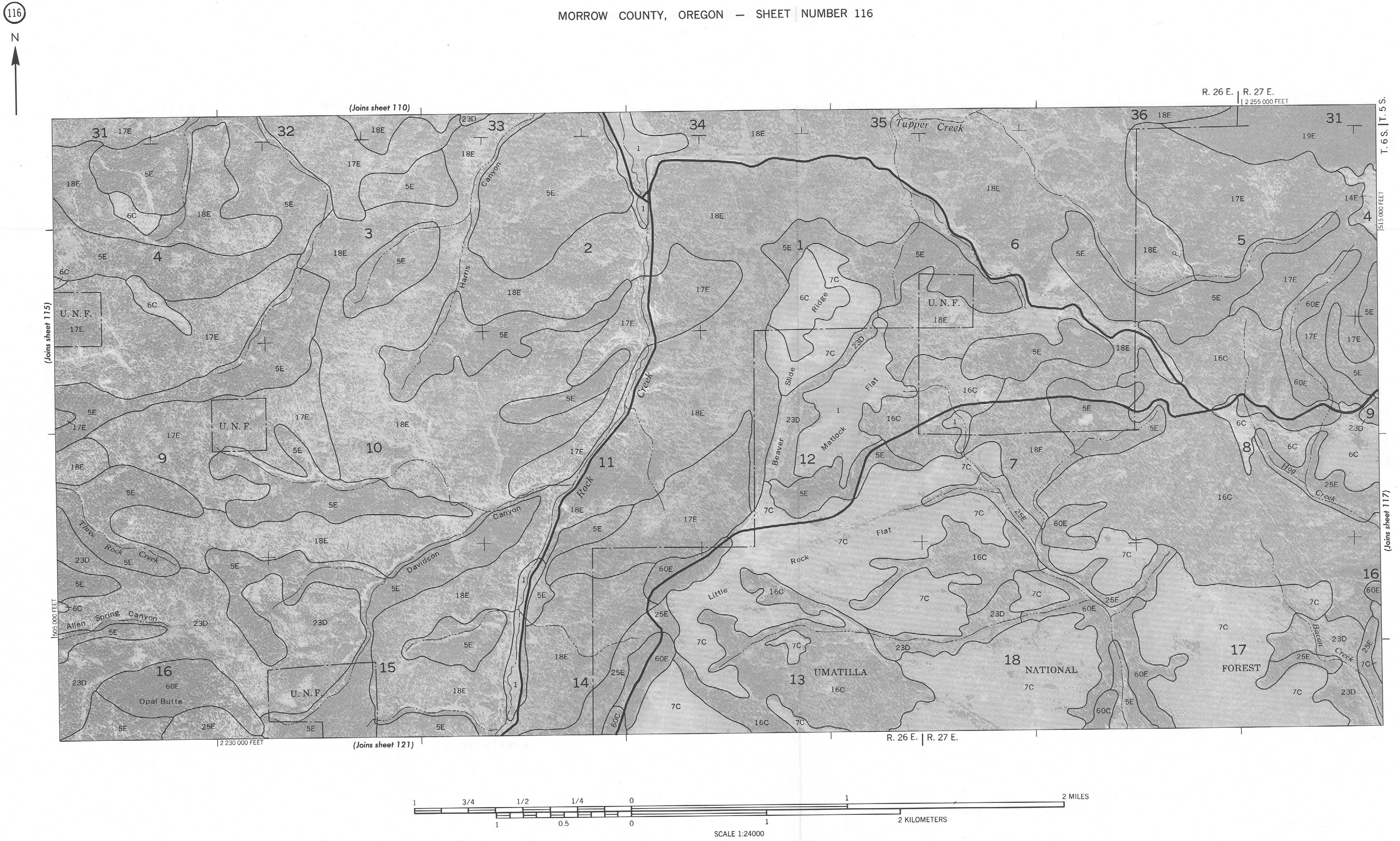
MORROW COUNTY, OREGON — SHEET NUMBER 115


N
(Joins sheet 109)
(Joins sheet 120)
(Joins sheet 114)
(Joins sheet 116)
R. 25 E. | R. 26 E.
T. 6 S. | T. 5 S.
2 195 000 FEET
2 225 000 FEET
515 000 FEET
505 000 FEET
Little Round Butte
Middle Fork Rock Creek
McDaniel Creek
Chapin Creek
Juniper Creek
Lava Flat
Hayden Prairie
Miller Prairie
Indian Creek
Allen Spring Canyon
U. N. F.
207
31
32
33
34
35
36
31
4
3
2
1
6
5
9
10
11
12
7
8
16
15
14
13
18
17
5E
6C
18E
23D
25E
69D
50D
61E
73E
24E
14E
17E
1
SCALE 1:24000
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

MORROW COUNTY, OREGON NO. 115

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

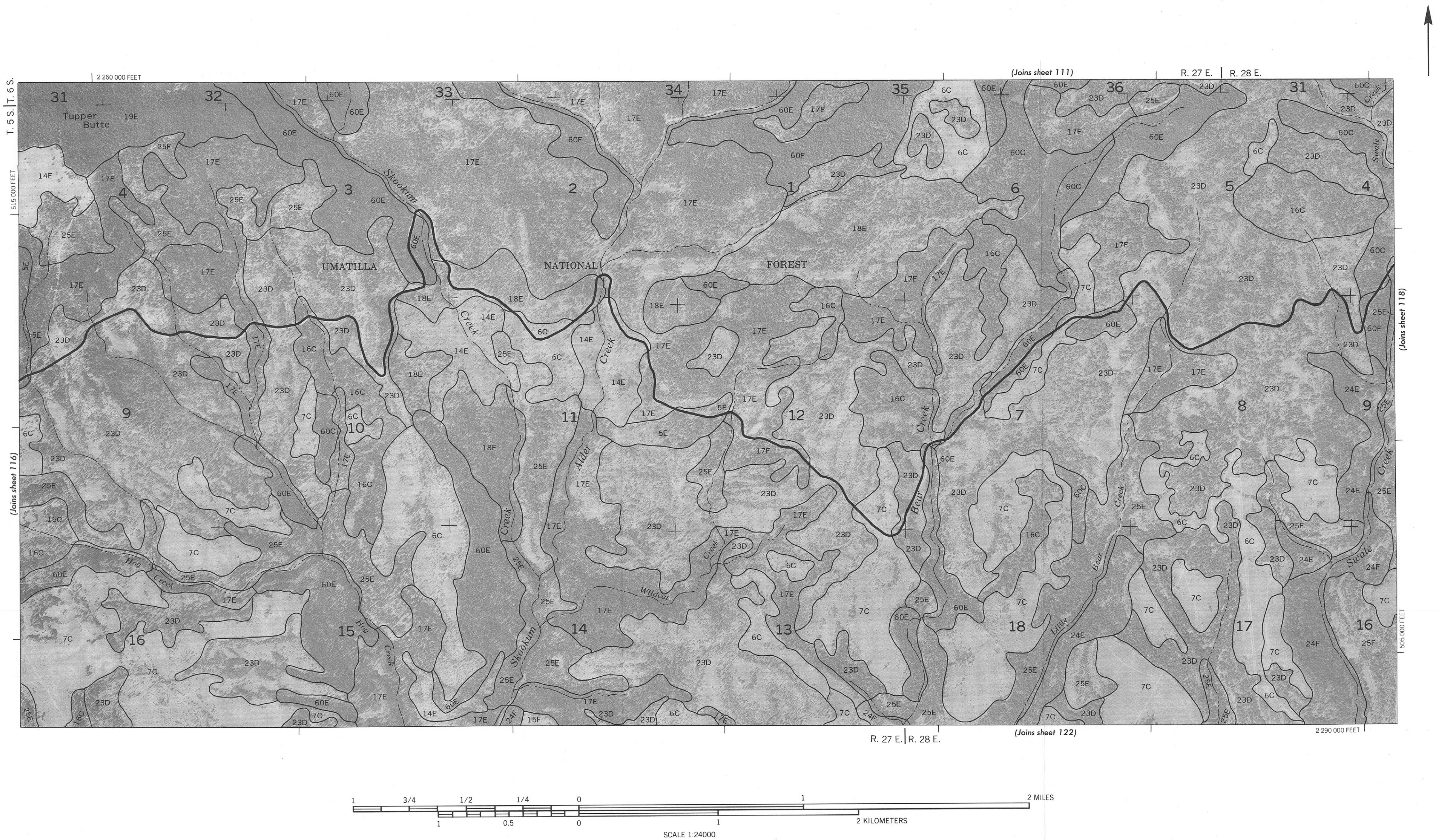
MORROW COUNTY, OREGON — SHEET NUMBER 116


116
N
(Joins sheet 110)
(Joins sheet 115)
(Joins sheet 117)
(Joins sheet 121)
R. 26 E. R. 27 E.
T. 5 S.
T. 6 S.
2 255 000 FEET
2 230 000 FEET
515 000 FEET
505 000 FEET
31
32
33
34
35
36
4
3
2
1
6
5
9
10
11
12
7
8
16
15
14
13
18
17
Tupper Creek
Harris Canyon
Rock Creek
Davidson Canyon
Three Rock Creek
Allen Spring Canyon
Opal Butte
Slide Ridge
Matlock Flat
Beaver
Little Rock Flat
Hog Creek
Bacon Creek
U. N. F.
UMATILLA NATIONAL FOREST
17E
18E
5E
6C
7C
1
14E
19E
16C
23D
25E
60E
60C
SCALE 1:24000
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 116

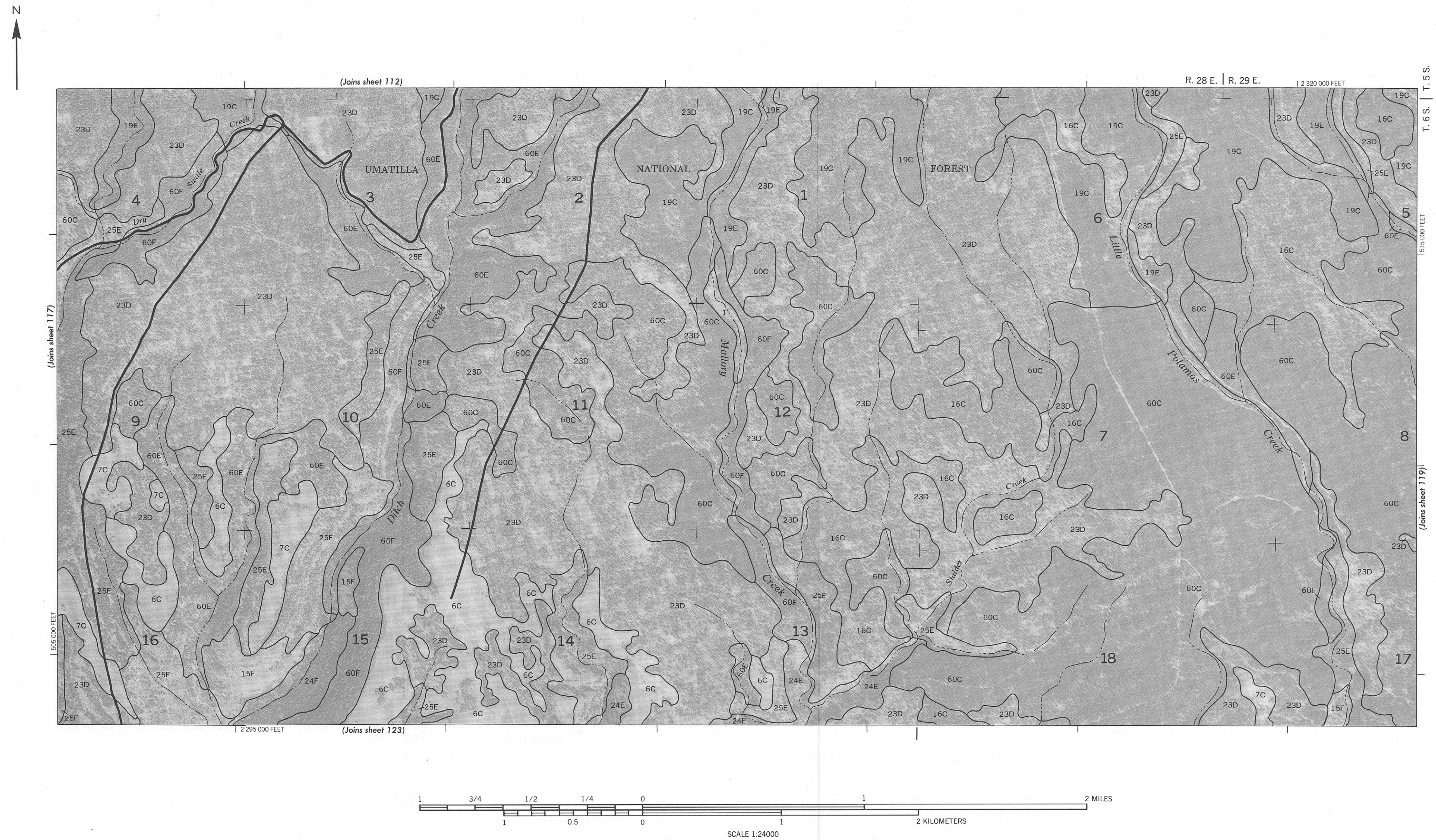
MORROW COUNTY, OREGON — SHEET NUMBER 117


117
N
(Joins sheet 111)
(Joins sheet 116)
(Joins sheet 118)
(Joins sheet 122)
R. 27 E. | R. 28 E.
T. 5 S. | T. 6 S.
2 260 000 FEET
515 000 FEET
505 000 FEET
2 290 000 FEET
Tupper Butte
UMATILLA
NATIONAL
FOREST
Skookum Creek
Alder Creek
Bear Creek
Little Bear Creek
Hog Creek
Wildcat Creek
Swale Creek
31
32
33
34
35
36
31
4
3
2
1
6
5
4
9
10
11
12
7
8
9
16
15
14
13
18
17
16
19E
14E
17E
25E
23D
60E
18E
14E
6C
16C
7C
60C
5E
24E
24F
25F
15F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON NO. 117

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MORROW COUNTY, OREGON — SHEET NUMBER 118


N
(Joins sheet 112)
R. 28 E. | R. 29 E.
2 320 000 FEET
T. 5 S.
T. 6 S.
(Joins sheet 117)
(Joins sheet 119)
515 000 FEET
505 000 FEET
2 295 000 FEET
(Joins sheet 123)
UMATILLA
NATIONAL
FOREST
Dry
Swale
Creek
Creek
Ditch
Mallory
Creek
Little
Potamus
Creek
Slalder
Creek
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
23D
19E
19C
23D
60F
60C
25E
60F
23D
23D
60E
60E
23D
25E
60E
19C
19E
19C
19C
23D
19E
60C
60C
60C
23D
60F
60C
19C
23D
16C
19C
25E
19C
23D
19E
19C
16C
23D
25E
19C
19C
60E
16C
60C
60C
60C
60E
60C
23D
23D
60C
60C
16C
23D
16C
7C
60E
7C
25E
60E
6C
23D
7C
25E
6C
60E
7C
25E
25F
15F
6C
25F
15F
24F
60F
6C
25E
6C
23D
23D
23D
6C
6C
25E
24E
6C
60E
6C
24E
25E
24E
23D
16C
23D
60C
16C
25E
60C
60C
23D
60C
60E
23D
7C
23D
15F
25F
23D
7C

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

MORROW COUNTY, OREGON NO. 118

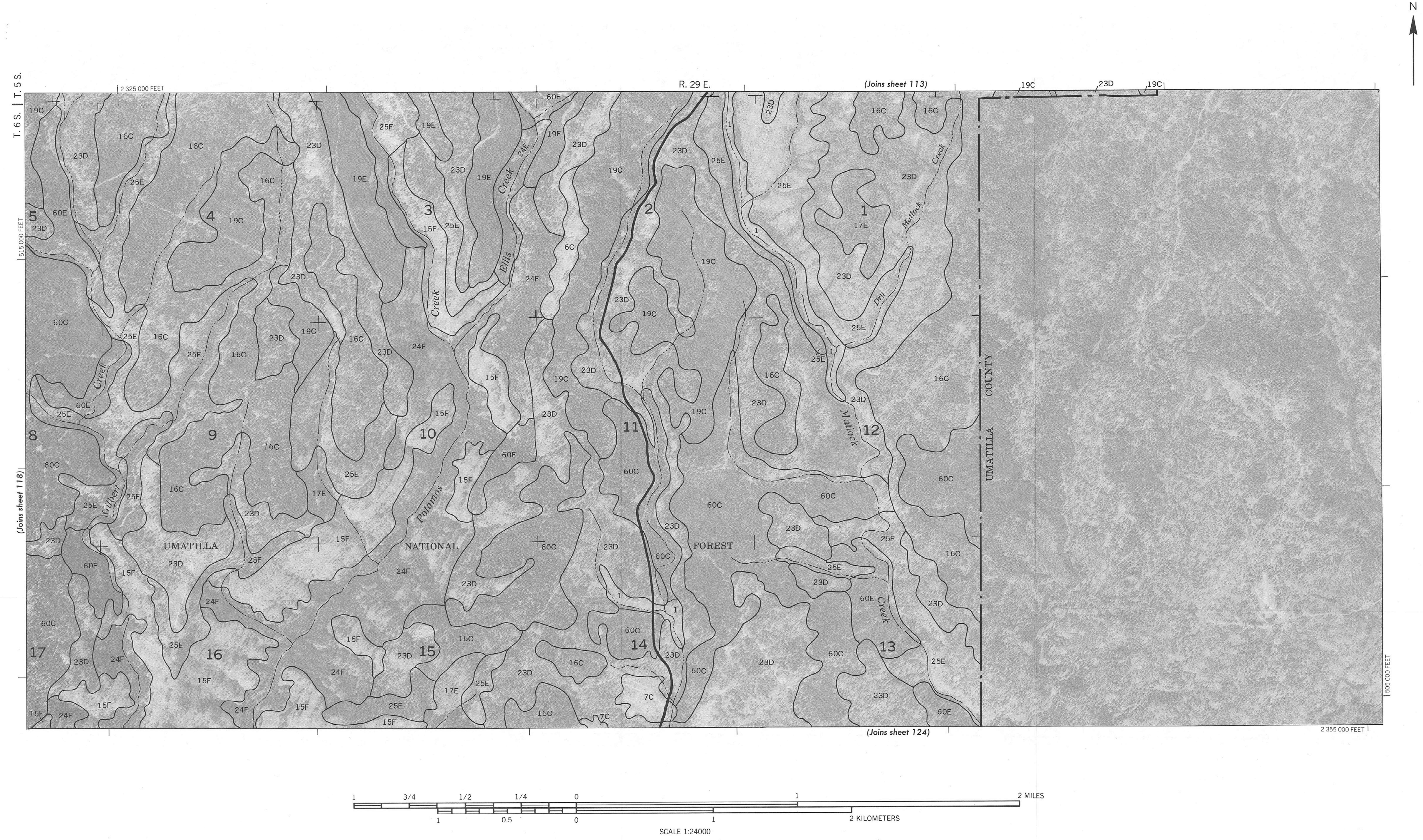
MORROW COUNTY, OREGON — SHEET NUMBER 119

MORROW COUNTY, OREGON NO. 119

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

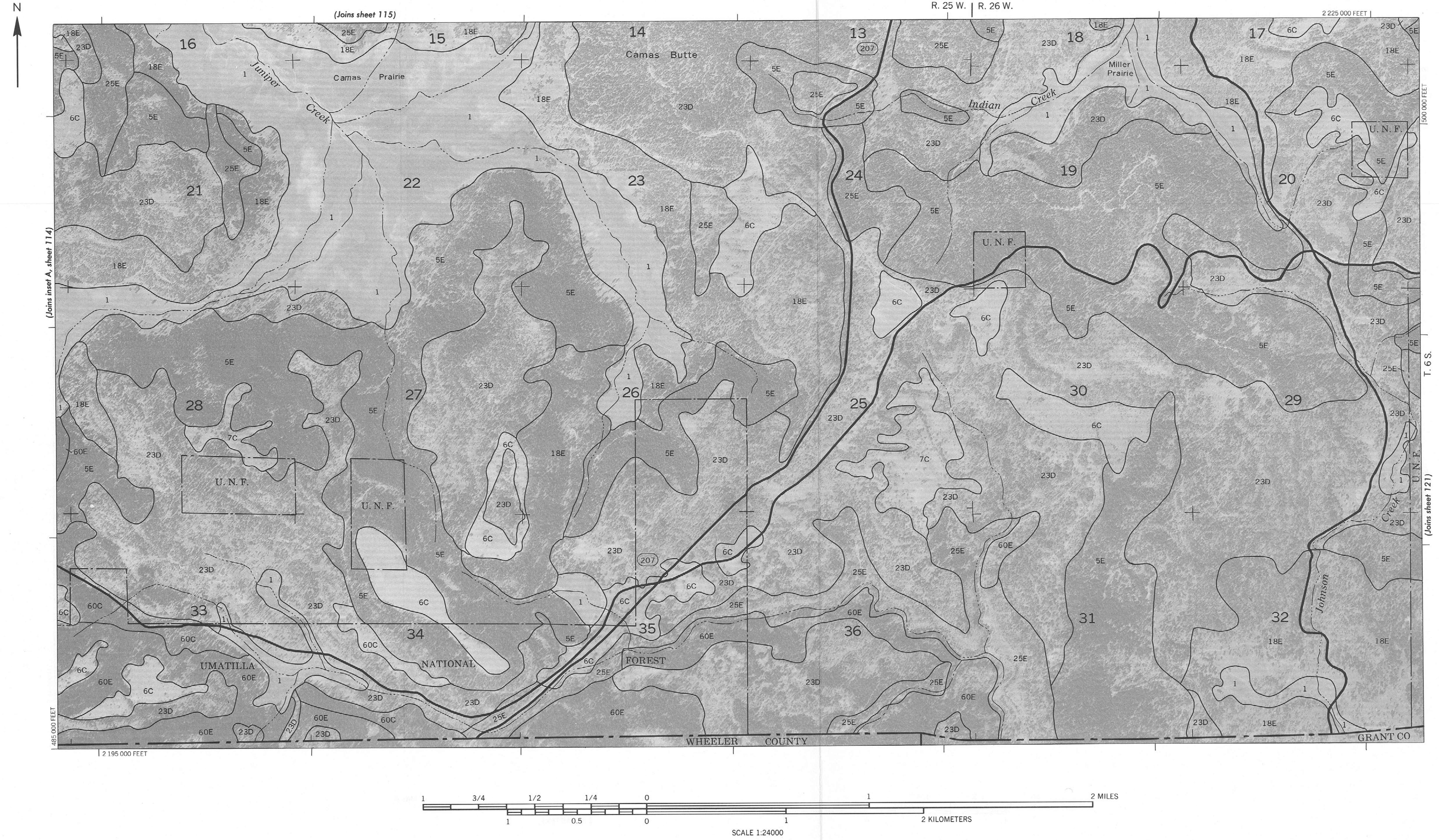
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1976 and 1977 aerial photography.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.


119
N
2 325 000 FEET
R. 29 E.
(Joins sheet 113)
(Joins sheet 118)
(Joins sheet 124)
T. 5 S.
T. 6 S.
515 000 FEET
505 000 FEET
2 355 000 FEET
UMATILLA NATIONAL FOREST
UMATILLA COUNTY
Gilbert Creek
Ellis Creek
Potamos Creek
Matlock Creek
Dry Creek
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
16C
19C
23D
25E
60C
60E
15F
24F
17E
19E
1
6C
7C
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

120

MORROW COUNTY, OREGON — SHEET NUMBER 120


N
(Joins sheet 115)
(Joins inset A, sheet 114)
(Joins sheet 121)
R. 25 W.
R. 26 W.
T. 6 S.
2 225 000 FEET
500 000 FEET
485 000 FEET
2 195 000 FEET
Camas Butte
Camas Prairie
Juniper Creek
Indian Creek
Miller Prairie
Johnson Creek
207
U. N. F.
UMATILLA NATIONAL FOREST
WHEELER COUNTY
GRANT CO
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
1
5E
6C
7C
18E
23D
25E
60C
60E
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

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MORROW COUNTY, OREGON NO. 120

MORROW COUNTY, OREGON — SHEET NUMBER 121

MORROW COUNTY, OREGON NO. 121

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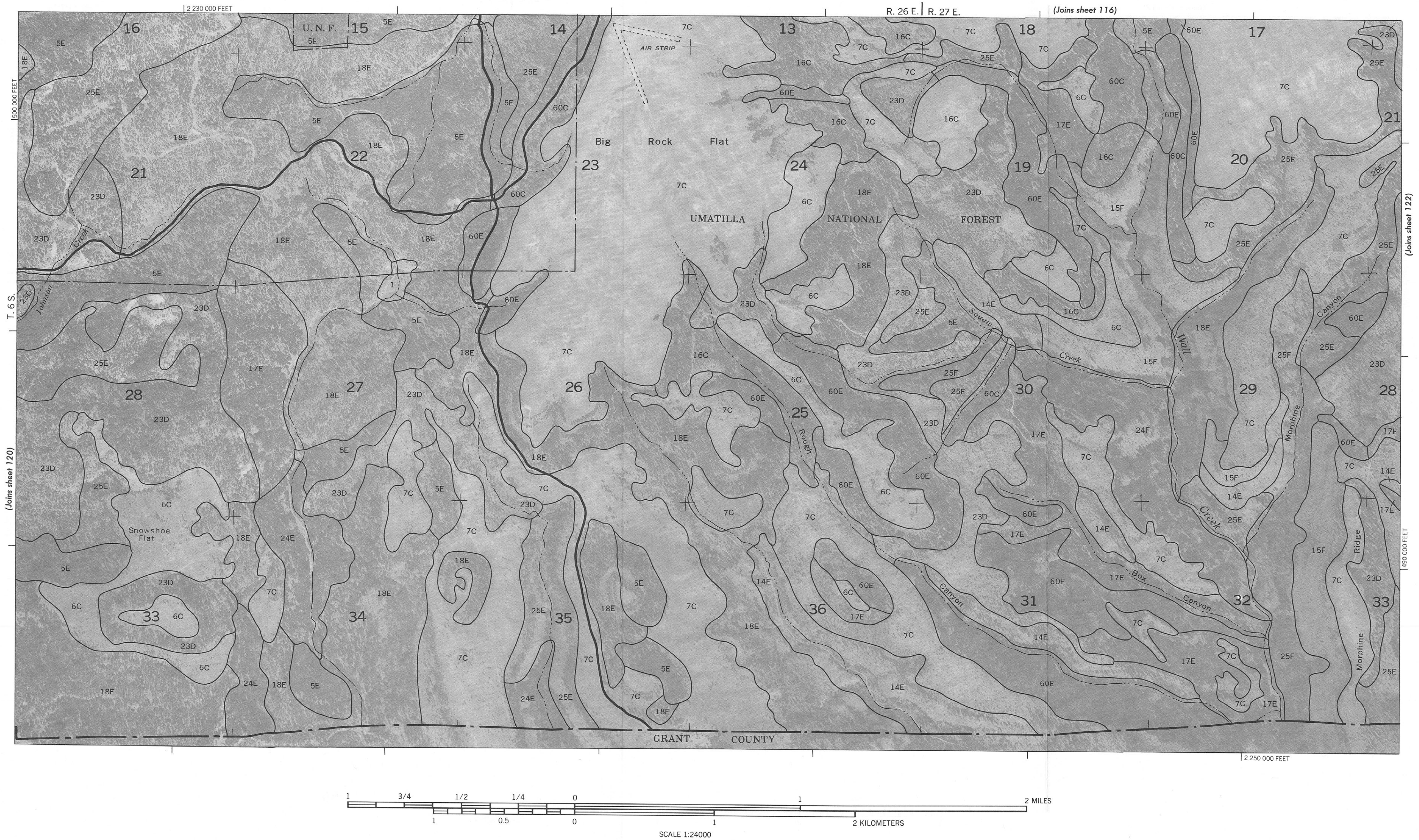
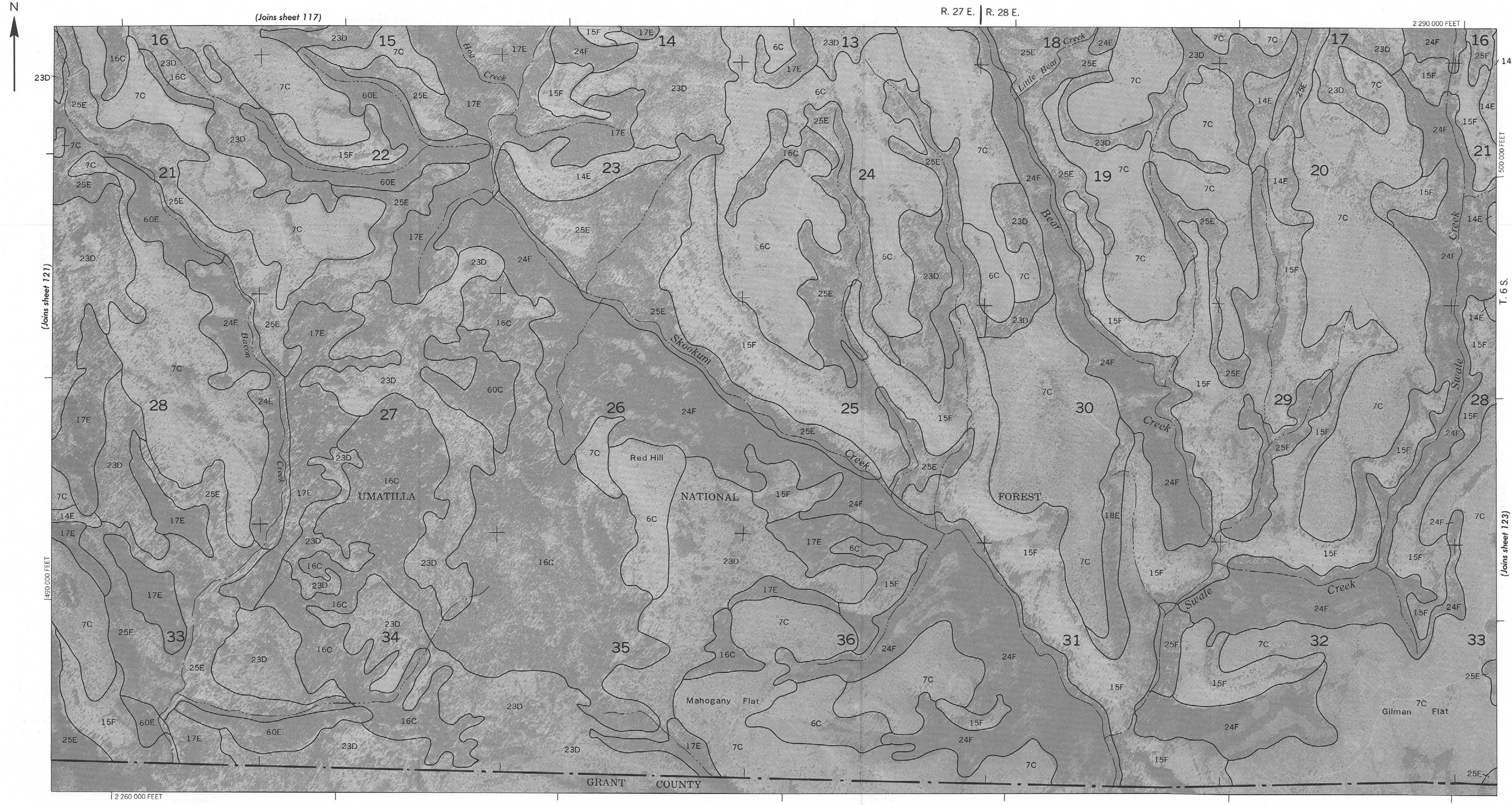

N
2 230 000 FEET
R. 26 E. | R. 27 E.
(Joins sheet 116)
(Joins sheet 122)
(Joins sheet 120)
500 000 FEET
490 000 FEET
2 250 000 FEET
T. 6 S.
U.N.F.
AIR STRIP
Big Rock Flat
UMATILLA NATIONAL FOREST
Johnson Creek
Snowshoe Flat
Squaw Creek
Wall Creek
Rough
Canyon
Box Canyon
Creek
Morphine Ridge
Morphine
GRANT COUNTY
16
15
14
13
18
17
21
22
23
24
19
20
28
27
26
25
30
29
34
35
36
31
32
33
5E
18E
25E
23D
60C
60E
7C
16C
6C
17E
24E
14E
15F
25F
24F
1
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 122


N
(Joins sheet 117)
R. 27 E.
R. 28 E.
2 290 000 FEET
500 000 FEET
T. 6 S.
(Joins sheet 121)
(Joins sheet 123)
490 000 FEET
2 260 000 FEET
Hog Creek
Little Bear Creek
Bear Creek
Skookum Creek
Bacon Creek
Swale Creek
Red Hill
UMATILLA
NATIONAL
FOREST
Mahogany Flat
Gilman Flat
GRANT COUNTY
16
15
14
13
18
17
21
22
23
24
19
20
28
27
26
25
30
29
33
34
35
36
31
32

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
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MORROW COUNTY, OREGON — SHEET NUMBER 123

MORROW COUNTY, OREGON NO. 123

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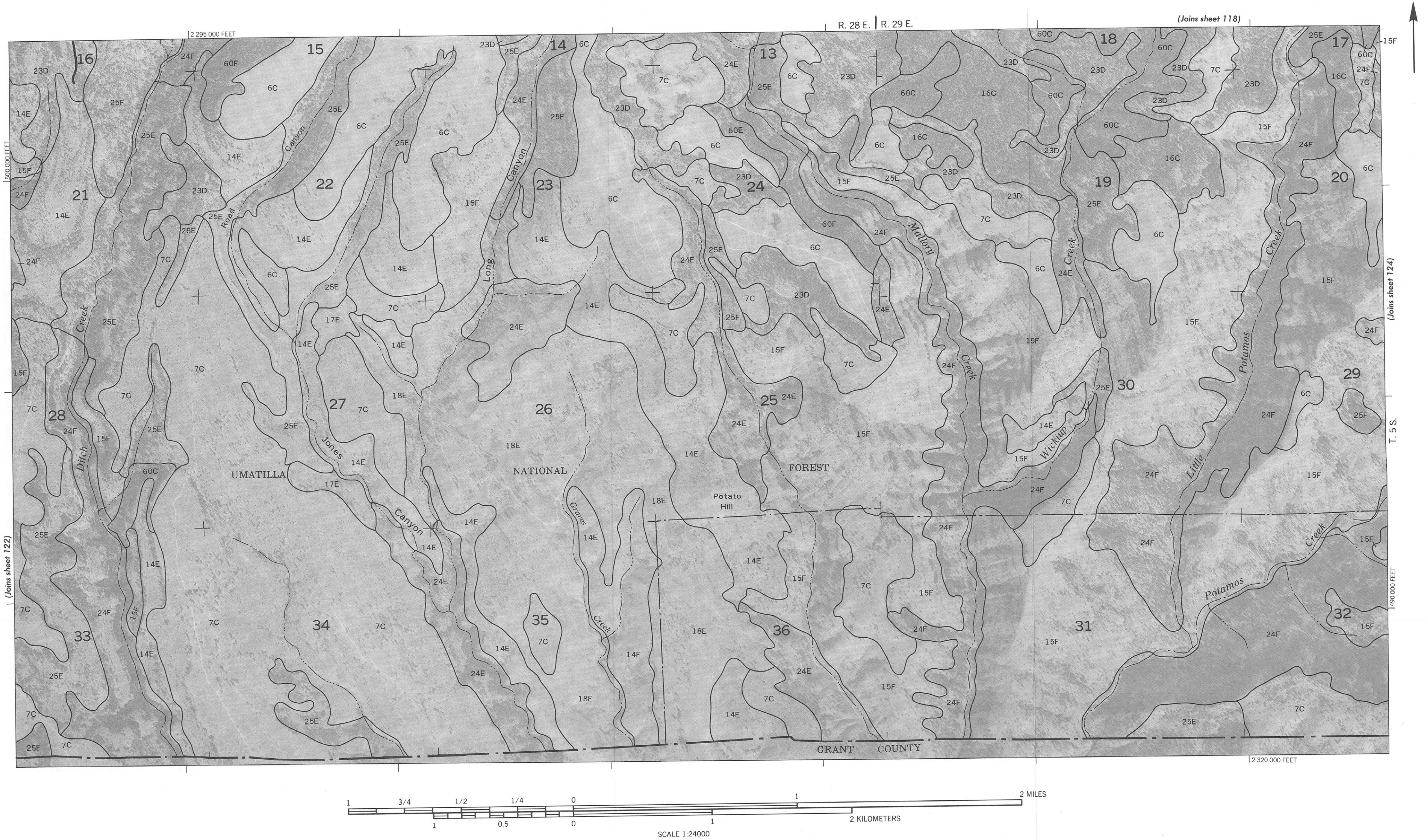
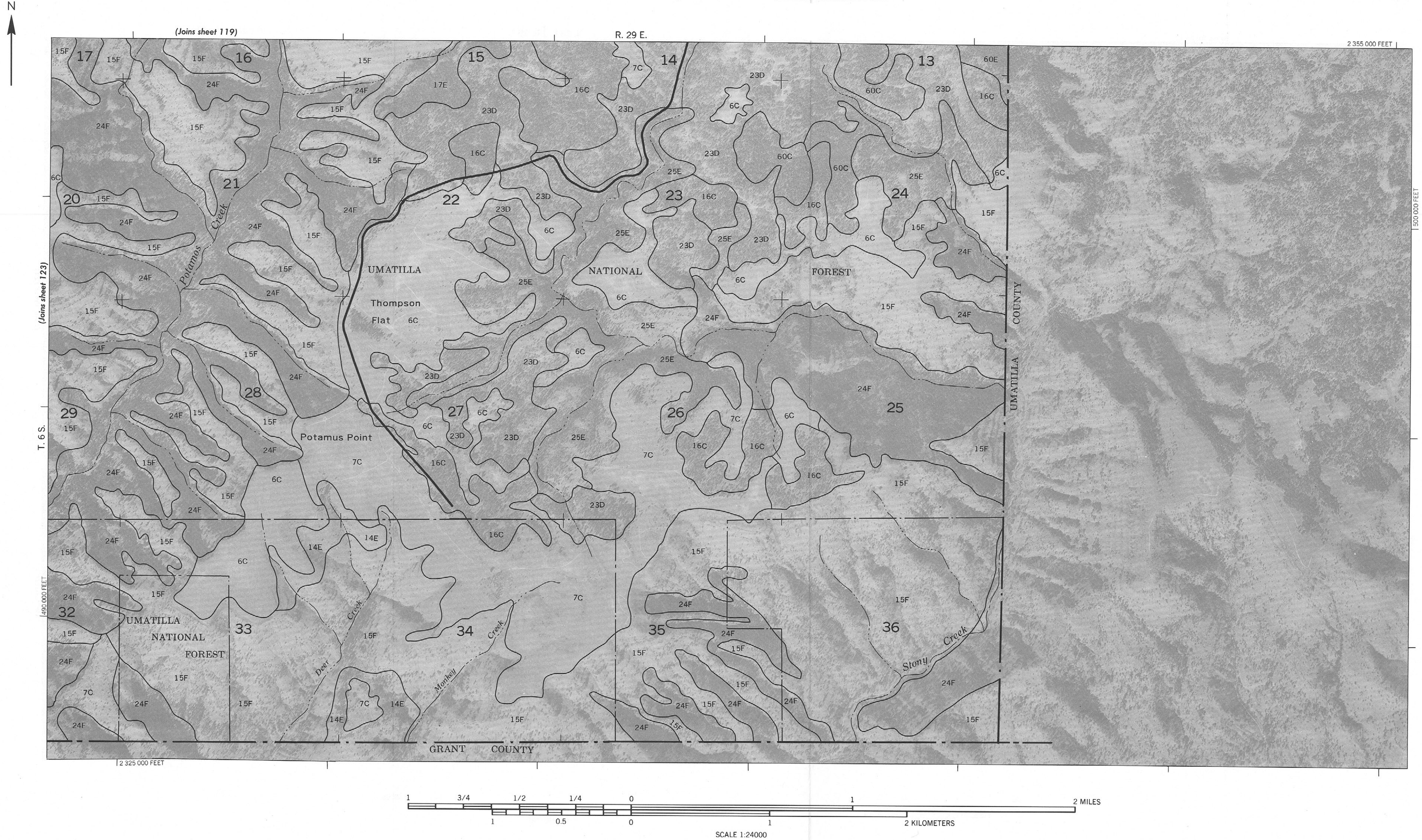

N
(Joins sheet 118)
(Joins sheet 124)
(Joins sheet 122)
R. 28 E. | R. 29 E.
T. 5 S.
2 295 000 FEET
2 320 000 FEET
500 000 FEET
490 000 FEET
UMATILLA
NATIONAL
FOREST
GRANT COUNTY
Potato Hill
Road Canyon
Long Canyon
Jones Canyon
Creek Ditch
Graves Creek
Mallory Creek
Wickiup Creek
Little Potamos Creek
Potamos Creek
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
6C
7C
14E
15F
16C
17E
18E
23D
24E
24F
25E
25F
60C
60E
60F
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

MORROW COUNTY, OREGON — SHEET NUMBER 124


N
(Joins sheet 119)
R. 29 E.
2 355 000 FEET
500 000 FEET
(Joins sheet 123)
T. 6 S.
490 000 FEET
2 325 000 FEET
17
16
15
14
13
20
21
22
23
24
29
28
27
26
25
32
33
34
35
36
UMATILLA
NATIONAL
FOREST
Thompson
Flat
Potamus Point
Potamus Creek
Deer Creek
Monkey Creek
Stony Creek
UMATILLA COUNTY
GRANT COUNTY
15F
24F
17E
23D
16C
7C
6C
60C
60E
25E
14E
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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MORROW COUNTY, OREGON NO. 124